

NUCLEAR THEFT: REAL AND IMAGINED DANGERS

Robert Caldwell Mabry

NAVAL POSTGRADUATE SCHOOL

Monterey, California



THESIS

NUCLEAR THEFT: REAL AND IMAGINED DANGERS

by

Robert Caldwell Mabry, Jr.

March 1976

Thesis Advisor:

R. H. Stolfi

Approved for public release; distribution unlimited.

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Nuclear Theft: Real and Imagined Dangers		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis; March 1976
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Robert Caldwell Mabry, Jr.		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		12. REPORT DATE March 1976
		13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Naval Postgraduate School Monterey, California 93940		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Nuclear Theft: Real and Imagined Dangers examines the possibility of theft of fissionable material from the U.S. nuclear power industry by non-governmental individuals or groups. The study investigates the availability of fissionable material, vulnerable portions of the nuclear fuel cycles, weapon construction, and the regulations regarding the protection of fissionable material. The study uses a		

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

morphological approach to evaluate the capability of potential thieves by group size and classification. Possible motivations for committing nuclear theft are discussed.

Nuclear Theft: Real and Imagined Dangers

by

Robert Caldwell Mabry, Jr.
Lieutenant, United States Navy
B.A., Monmouth College, 1970

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF ARTS IN NAVAL INTELLIGENCE

from the

ABSTRACT

Nuclear Theft: Real and Imagined Dangers, examines the possibility of theft of fissionable material from the U.S. nuclear power industry by non-governmental individuals or groups. The study investigates the availability of fissionable material, vulnerable portions of the nuclear fuel cycles, weapon construction, and the regulations regarding the protection of fissionable material. The study uses a morphological approach to evaluate the capability of potential thieves by group size and classification. Possible motivations for committing nuclear theft are discussed.

TABLE OF CONTENTS

I.	INTRODUCTION-----	10
A.	HISTORICAL OVERVIEW-----	16
B.	METHODOLOGY-----	19
II.	FISSIONABLE PRODUCTS OF THE NUCLEAR POWER INDUSTRY-----	21
A.	PLUTONIUM-239-----	25
B.	URANIUM-235-----	28
C.	URANIUM-233-----	28
III.	FUEL CYCLE VULNERABILITY-----	30
A.	HIGH TEMPERATURE GAS-COOLED REACTOR-----	31
B.	LIQUID METAL FAST BREEDER REACTOR-----	32
C.	LIGHT WATER REACTOR-----	34
IV.	WEAPON CONSTRUCTION-----	41
A.	METHODS OF BOMB CONSTRUCTION-----	44
1.	Gun Geometry-----	44
2.	Implosion Geometry-----	45
3.	Comparison of Methods-----	47
B.	RADIOLOGICAL WEAPONS AND DISPERSAL DEVICES-----	49
V.	PRIMARY METHODS OF SAFEGUARDING FISSIONABLE MATERIAL-----	51
A.	OVERVIEW-----	51
B.	DIVERSION-----	52
C.	THEFT OF FISSIONABLE MATERIAL FROM STORAGE AREAS-----	55

D.	NUCLEAR HIJACKING-----	61
1.	Assessment of Transportation Safeguards-----	66
E.	FEDERAL RESPONSE PLANS-----	66
VI.	THREAT EVALUATION-----	72
A.	CAPABILITY-----	72
1.	Resources-----	72
2.	Motivation-----	73
B.	MORPHOLOGICAL APPROACH-----	76
C.	GROUPS WITH SUFFICIENT CAPABILITY TO CONDUCT A NUCLEAR THEFT-----	81
1.	Employee Theft-----	81
2.	Theft by Terrorists-----	83
3.	Theft by Criminal Organizations-----	88
VII.	CONCLUSION-----	92
A.	GENERAL CONCLUSIONS-----	92
B.	SPECIFIC CONCLUSIONS-----	93
1.	The Availability of Weapons-Grade Material--	93
2.	Weapon Construction-----	94
3.	Safeguards Adequacy-----	95
4.	Who Poses a Significant Threat-----	95
APPENDIX A:	The Energy Reorganization Act of 1974-----	98
APPENDIX B:	Physical Protection of Plants and Materials-----	119
APPENDIX C:	Training, Equipping and Qualifying of Guards and Watchmen-----	125
BIBLIOGRAPHY	-----	140
INITIAL DISTRIBUTION LIST	-----	143

LIST OF TABLES

I.	Indications of Growth in the U.S. Nuclear Safeguards Program-----	59
II.	Assessment of Transportation Safeguards Improvements - 1974-----	67
III.	Proposed Additional Transport Protection Requirements-----	68
IV.	Proposed Additional Transport Protection Requirements (Continued)-----	69

LIST OF FIGURES

1.	Illustration of Neutron Capture by Fissile Nucleus-----	22
2.	Plutonium Production-----	26
3.	Generalized Fuel Cycle for Light Water Reactors (without Plutonium Recycle)-----	35
4.	Generalized Fuel Cycle for Light Water Reactors (with Plutonium Recycle)-----	39
5.	Principles of a Gun Geometry Weapon-----	46
6.	Principles of an Implosion Geometry Weapon-----	48
7.	Spectrum Showing Possible Theft Motivation-----	75
8.	Morphological Approach to Threat Evaluation-----	77



Source: San Francisco Chronicle, 20 April 1975

I. INTRODUCTION

"Norfolk, Va. — Yesterday it was discovered by Virginia law enforcement officials that 25 kilograms of plutonium nitrate in solution were stolen in a murder-hijacking near the Atlantic coast resort town of Virginia Beach. The plutonium, on its way from a reprocessing plant in South Carolina to an undisclosed storage facility in New York State, was hijacked despite federal safeguards to protect against such an event. The hijacking was the first of its kind in that no theft of nuclear "bomb" material has ever been reported. As a result of the theft, a 10-state "dragnet" has been instituted, the FBI revealed. Although the FBI will coordinate the search, a command post has been set up here by members of the Nuclear Regulatory Commission (NRC) and the Energy Resources Development Administration (ERDA). To assist the law enforcement agencies in their search, the NRC and ERDA personnel have provided some aircraft and equipment useful in localizing the plutonium; however, experts say the equipment must be very close to the radioactive material before a detection can be made.

The first report that the hijacking had taken place came from state troopers patrolling an isolated stretch of Highway 17. Motorists stopped to assist a reprocessing plant guard who had been shot several times. The guard, left for dead

by his assailants in a nearby ditch, was able to explain that he had been shot by men wearing plant security uniforms like his own. A second guard was found dead a few minutes later. Both men were taken to Virginia Beach Hospital.

The surviving guard, identified as Mr. Henry Hanson of Boone Mountain, South Carolina, was listed in serious condition after sustaining gun-shot wounds to the chest and abdomen. The second guard, also the escort companion of Mr. Hanson, was pronounced dead on arrival; his name is being withheld pending notification of next of kin. Although wounded, Mr. Hanson was able to give the FBI an extensive account of circumstances surrounding the hijacking. The FBI said that the Ajax tractor-trailer which had been contracted to carry the plutonium was proceeding north along a deserted stretch of Highway 17. The truck was being escorted by the two guards in a reprocessing plant security vehicle. For no apparent reason the semi pulled off the highway into a protected area and summoned the assistance of Mr. Hanson by radio. Upon opening the cab of the tractor, Mr. Hanson was gunned down by the driver. When asked about his recollection of the alternate truck driver during the shooting, Mr. Hanson reported that he thought the other driver was unconscious on the truck floor.

The circumstances surrounding the shooting of the guard driving the escort vehicle are uncertain at this time, although police believe that the truck driver had assistance from another vehicle. This would account for the fact that

both the tractor-trailer and the escort vehicle were stolen from the scene and are still missing.

The plutonium, enough to make several nuclear weapons or cause thousands of cancers if properly dispersed, was not in a form directly useable in a bomb, ERDA officials claimed. However, many knowledgeable scientists around the country say that relatively simple conversion techniques can change the plutonium nitrate into a form required for use in nuclear weapons. ERDA officials would not comment on why anyone would want the plutonium except to say that every possible avenue is being explored. The net value of the plutonium is said to be on the order of \$10,000 per kilogram, considerable more than gold or silver."

The past few years have been marked by an increase in media, special interest groups and now public concern over the tremendous, world-wide proliferation of nuclear material as a result of the growth of the nuclear power industry. Closely associated with this concern is a fear that the proliferation of nuclear material will lead to the theft of material which could be fashioned into an "atomic bomb" or some other insidious weapon. In addition to the proliferation problem, these fears have been fueled by the unprecedented growth in terrorist activities, the inability of our institutions to check escalating crime rates and, perhaps, a deep-seated fear of nuclear power itself. There is a growing minority of nuclear power critics and advocates who feel that unless procedures used to safeguard nuclear

material are improved substantially, nuclear theft will become a reality. The fictitious newspaper article presented above was meant to be representative of the type of future dilemma foreseen.¹

This thesis is the culmination of a study which has examined a problematic question: is the theft of fissionable material from the U.S. nuclear power industry a credible possibility? Several constraints have been applied to limit the scope of the study as a practical matter. For the purposes of this discussion, nuclear theft is defined as the covert, clandestine or overt theft of nuclear material which could feasibly be used to produce a fission explosion. Specifically, this study will concern itself with the theft of U.S. nuclear material by non-governmental individuals or groups and divorces itself from the problem of diversion by foreign governments. Furthermore, this study will concern itself primarily with nuclear material in the hands of private industry, i.e., those materials subject to the regulations of the Nuclear Regulatory Commission (NRC).

There are several reasons for the emphasis on the industrial aspects and applications of fissionable material. Presently in the United States, there are three prime users of weapons-grade nuclear material. The newly-formed Energy Research and Development Administration (ERDA) and its three

¹ The scenario presented in the article was meant to find some middle ground between overzealous newspaper scenarios showing 20 blood-thirsty terrorists brandishing automatic weapons and some industry spokesmen who would have one believe there is no threat.

major laboratory complexes (Los Alamos Scientific Laboratory, Lawrence Livermore Laboratory and the Scandia Laboratories) perform the majority of weapons research and development associated with the U.S. nuclear weapons program. Additionally, ERDA conducts related programs which include power reactor design, experimentation, and safety analysis, peaceful and industrial nuclear explosive applications, controlled thermo-nuclear power research, and laser fusion projects as well as others.

The second major user of weapons-grade material in the United States is the military. The military programs include weapons development, nuclear propulsion, and other systems associated with space programs. The military and ERDA enjoy a symbiotic relationship in that nuclear weapons, propulsion units, etc., are designed for military specifications and custodied to the military by ERDA. The military does not have self-administered research and development programs.

The other major producer/user of weapons-grade nuclear material in the United States is the nuclear power industry. As intimated earlier, the expansion of nuclear power is rapidly producing more and more fissionable material. The following quote is representative of that growth and the commensurate concern:

"Plutonium cannot be used as fuel without first undergoing processing in special plants; moreover, the spent fuel by-products, called fission products, many of which remain highly radioactive for thousands and even hundreds of thousands of years, must be periodically removed from the reactor and shipped to storage and burial sites across the country... What this means

is that, in the plutonium economy envisioned by the AEC, enough plutonium to make thousands of bombs or lethal dispersal devices, and enough curies of radioactive waste to kill countless trillions of humans, will move along America's highways and railroads in thousands of shipments every year, to and from reactors, reprocessing plants,² fuel fabrication plants, and burial and storage sites.

Although the nuclear material referred to above is owned and produced by the private sector, it is controlled and regulated by the Nuclear Regulatory Commission. Among other things, the NRC is specifically charged with the responsibility of regulating all licensed activities associated with the processing, transport, and handling of nuclear materials. Additionally, the Commission is responsible for providing and maintaining safeguards against threats, thefts, and sabotage of nuclear facilities and materials.

Of the three major users of nuclear material, ERDA and the military have a distinct advantage in solving the problem of providing safeguards and properly protecting nuclear material, both organizations are able to use federal security personnel and equipment to insure adequate protection. On the other hand, the NRC must rely on private industry to provide its own protection, hopefully corresponding to the requirements set down by regulation. In order to achieve some perspective on the problems inherent in protecting fissionable material from theft, it will be useful to briefly examine the history of safeguards in the United States.

² "Can We Afford a Plutonium Economy," Natural Resources Defense Council Newsletter, Summer/Fall 1974.

A. HISTORICAL OVERVIEW

For the first ten years following the development of atomic weapons, the United States went to great pains to assure the secrecy of budding nuclear technology. From the early 40's under the auspices of the "Manhattan Project," the production and processing of nuclear material was under the direct and strict scrutiny of the military. Prior to the end of WW II, the nuclear material that had been developed was the world's supply and the only material suitable for use in a nuclear weapon. During this period and for a decade thereafter, the primary concern of the U.S. program for protecting nuclear material was first, that it might be diverted by foreign governments and, second, that it should be accounted for because nuclear material was expensive. In December of 1953, President Eisenhower made his famous "Atoms for Peace" proposal before the United Nations. As a result, the industrial use of fissionable material would demand that "nuclear secrets" formerly held under tight military control be declassified for consumption by private industry, although the nuclear material was still owned and regulated by the Federal Government. The legislation permitting this change came about with the Atomic Energy Act of 1954. Under this legislation the United States Government committed itself to a program of private nuclear power development and established an Atomic Energy Commission. The Commission was, among other things, charged with the encouragement and regulation of the nuclear power industry. The task of encouragement and

regulation resulted in a sort of legislated "conflict of interest" which was to contribute significantly to the demise of the AEC.

On 10 March 1967, the "Report to the Atomic Energy Commission by the Ad Hoc Advisory Panel on Safeguarding Special Nuclear Material," was submitted. This document, called the Lumb Report, was to make the AEC aware that the possibility of nuclear theft was real and that additional protection for nuclear material was required. Although a program of safeguards was submitted by the Ad Hoc panel, only a few of the safeguards were ever implemented. But, it was this document which more than anything else began the safeguard debate.

Until about 1973, the term "safeguards" referred to "measures to assure quick and reliable warning of any discrepancy in quantities of nuclear materials that could signal the theft and trigger recovery efforts."³ Recently, the definition of "safeguards" has been expanded considerably to include physical protection of material to prevent or deter a theft and plans to stop robberies and recover stolen property.

The perception of a "new threat" to nuclear material on the part of various special interest groups and government officials instigated a series of reports and a great deal

³ Donnelly, W. H., "Special Nuclear Materials: Safeguards Issue Brief Number IB74077," p. 2, The Library of Congress Congressional Research Service, 31 January 1975.

of publicity which highlighted the nuclear safeguards issue and brought it to the attention of Congress and the public.⁴

Some of the more noteworthy events are summarized below:

- 10 August 1973 - Reporters Morely Safer and Mike Wallace of CBS's "60 Minutes" gave a one-hour presentation which highlighted nuclear theft and its consequences during television's prime time.
- 7 November 1973 - A General Accounting Office (GAO) study reported to Congress on the inadequacy of the AEC's program of protecting special nuclear material.
- 7 April 1974 - Nuclear Theft: Risks and Safeguards by Willrich and Taylor was released. The report to the energy Policy Project by the Ford Foundation examines the possibilities of nuclear theft.
- 12 April 1974 - The GAO, in a report to Congress on the adequacy of protection afforded nuclear material in transit, chastised the AEC for its inadequate measures.
- 30 April 1974 - "The Special Safeguards Study" (the Rosenbaum Report) was placed in the Congressional Record by Senator Ribicoff. The report which was contracted by the AEC found that safeguards were inadequate as were new regulations, that the level of risk associated with nuclear theft was unacceptable, and that immediate steps should be taken to reverse an untenable situation.

Finally, on 11 October 1974, the Energy Reorganization Act of 1974 was signed into law. This act dissolved the Atomic Energy Commission and replaced it with the Energy Research and Development Administration (ERDA) and the Nuclear Regulatory Commission (NRC).

⁴ Although House and Senate Committees were interested in the functioning of the AEC for some time, these reports did much to foment legislative action which led to the Energy Reorganization Act of 1974.

The Act, among other things, charged the NRC with the regulation of all licensed⁵ activities associated with the processing, transportation and handling of special nuclear material. In order to insure that the "conflict of interests" problem would not reappear, the Commission has been made completely independent of the ERDA. Also, an Office of Nuclear Material Safety and Safeguards was established which reports directly to the NRC. The purpose of this office is to assess safeguard threats, recommend regulations and set up programs designed to protect against theft and sabotage. Since it is the central actor in the safeguards issue, the NRC will frequently be discussed with regard to its actions and regulations.

B. METHODOLOGY

In order to draw some substantive conclusions regarding the credibility of nuclear theft from the U.S. nuclear power industry, it will be beneficial to proceed by trying to answer or at least investigated five areas.

The first task will be to identify those products of the nuclear power industry which could be used to make a nuclear weapon of some kind. Secondly, it will be important to examine the nuclear fuel cycle. This "cycle" is made up of various industrial processes required to generate electrical

⁵ Special nuclear material can be held by organizations under government contract to ERDA, in which case it comes under ERDA regulation, or by private industry in which case it is licensed and regulated by the NRC.

energy from a nuclear power reactor. Only by examining these processes can some determination be made regarding the susceptibility of nuclear material to theft.

Having determined what nuclear materials can be used in a nuclear weapon, during what portions of the fuel cycle they are most susceptible, the study will turn to a discussion of weapon construction, or how difficult is it to produce a crude nuclear device?

Since the safeguard issue plays such an important and controversial role in assessing the problem of nuclear theft, considerable emphasis will be given to this portion of the study. The safeguard regulations emphasized will be those which are applicable to the most vulnerable portions of the nuclear fuel cycle.

The final portion of the text will attempt to evaluate the threat posed to special nuclear material. Its purpose is to isolate and discuss those groups and individuals who not only appear to have sufficient resources to successfully steal fissionable material but appear to be suitably motivated, as well. The threat portion of this study was undoubtedly the most demanding of the several areas investigated; the results are, also, the least certain due primarily to the imprecision associated with assessments of motivation. However, it is hoped that when coupled with the foregoing portions of the text, some significant and useful conclusions can be drawn.

II. FISSIONABLE PRODUCTS OF THE NUCLEAR POWER INDUSTRY

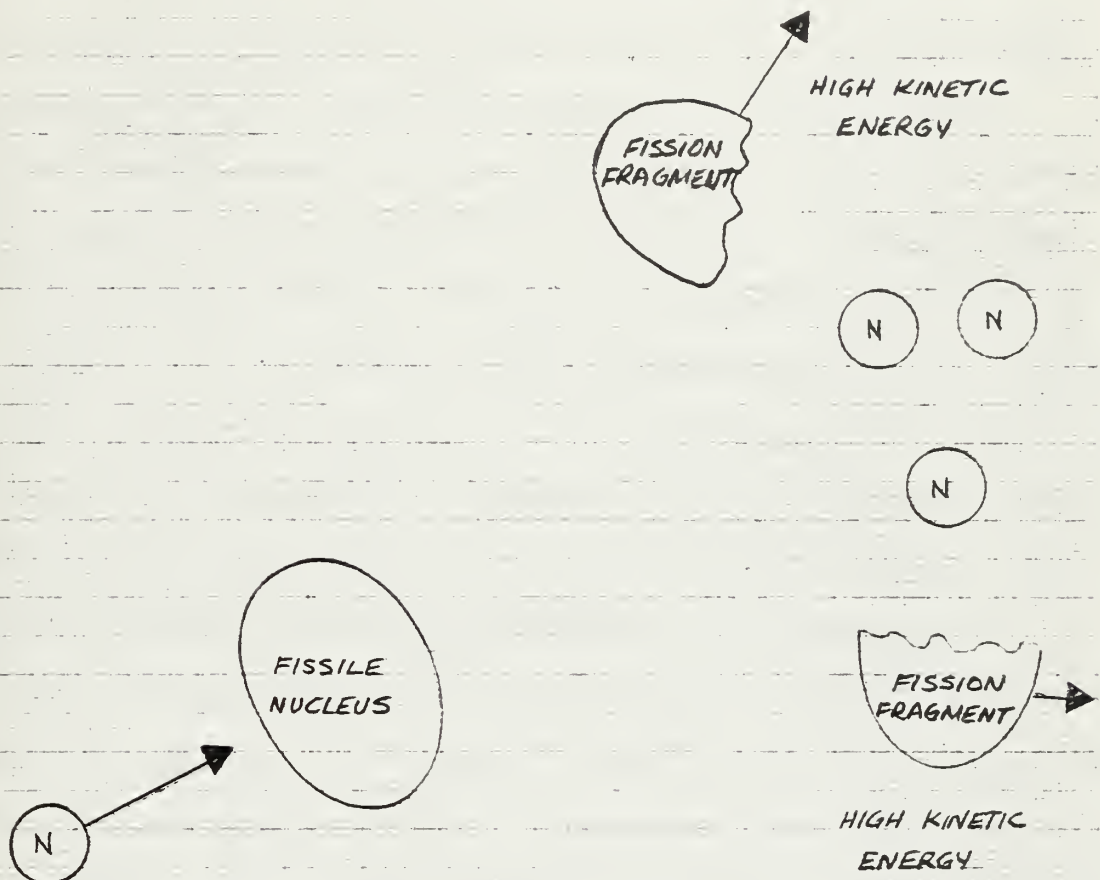
In the following section, it will be useful to identify those fissionable products of the nuclear power industry which could be used as the core material in a fission weapon by an enterprising individual or group. The discussion concerns itself with fission weapons only. This is due to the fact that fusion weapons are generally an order of magnitude more sophisticated with regard to money, technology and materials required. In fact, a fission weapon or "trigger" is required to create the heat necessary to permit the fusion of light nuclei, thus forming heavier atoms and releasing "thermo-nuclear" energy.⁶ Therefore, what is required of the fission weapon is, in a limited sense, also required of the fusion weapon.

Not all industrial nuclear materials are suitable to produce a fission explosion. The essential ingredient is that the material be capable of sustaining a fission chain reaction, i.e., the material must contain an isotope⁷ that is fissionable by neutrons of all energies (see figure 1).

⁶ Glasstone, S., ed., The Effects of Nuclear Weapons, p. 21-23, United States Atomic Energy Commission, April 1962.

⁷ The term "isotope" refers to one of two or more atoms with the same atomic number (the same chemical) but with different atomic weights. Thus, U^{238} and U^{235} are both elements of uranium but are different isotopes because their atomic weights differ slightly.

ILLUSTRATION OF NEUTRON CAPTURE BY FISSILE NUCLEUS



N = NEUTRON OF ANY ENERGY.

FISSILE NUCLEUS = U^{235} , U^{233} , Pu^{239} .

Figure 1

During the fission process, two to three new neutrons must be released in order to sustain the reaction. Essentially, three things can happen to these neutrons: 1) the neutrons can be captured by a suitable nucleus and thereby cause another fission event; 2) the neutrons can escape the surface of the material and be lost to the process; 3) the neutrons can be absorbed by a non-fissionable nucleus and be loss to the process. If it happens that neutrons are lost at a faster rate than they are produced by fission, there can be no self-sustained chain reaction. Consequently, in trying to produce a fission explosion there must be an effort to inhibit the loss of neutrons. This can be achieved in several ways.

Since one way for neutrons to escape is through the surface of the fissionable material, the loss rate is a function of the surface area, while the production rate is determined by the mass.⁸ So, by increasing the volume of the fissionable material, the ratio of neutrons lost compared to those produced becomes smaller. This directly bears on the concept of "critical-mass" which corresponds to the amount of material required such that more neutrons are produced than are lost. Thus, the number of fissions build tremendously.⁹

Another way to restrict the number of neutrons lost is by providing some type of reflector around the surface of

⁸ Op. Cit., Glasstone, p. 16-17.

⁹ Reese, W., Nuclear Weapons and Foreign Policy, unpublished class notes presented at the Naval Postgraduate School, p. 1-4, 1975.

the material, thereby bouncing the neutrons back into the core and increasing the likelihood that another fission will occur.

Still another means of restricting neutron loss would be to purify the fissionable material being used in order to reduce the probability that a given neutron will be absorbed by a non-fission element. Both of these methods tend to reduce the amount of material required to form a critical-mass.

The critical-mass of the material used must be small enough to suit the needs of the bomb designer. Some isotope concentrations may require so much mass to be critical as to be non-transportable by other than extraordinary means. Consequently, the quantity of fission material required to produce a nuclear explosion varies according to the type and purity of the material utilized. For the purposes of this discussion there are three widely used materials which lend themselves to use as fission explosives. They are plutonium-239, uranium highly enriched as the isotope 235, and uranium-233. All three of these materials are used extensively in the nuclear energy industry and are subject to transportation and storage during their individual processing cycles.¹⁰

¹⁰ Neither plutonium nor uranium-233 exist in nature. Uranium-235 composes only about .7% of uranium in its natural state. Consequently, these materials must be manufactured (in the case of uranium it must be enriched). The most important producer of these materials was the nuclear weapons industry; however, this position is being yielded to the U.S. nuclear energy industry.

A. PLUTONIUM-239

Plutonium is a material generated in nuclear reactors which utilize uranium-238 to sustain a controlled fission reaction. The neutrons released in the fission process must pass through a moderator which reduces their speed and increases the likelihood that they will be captured by the uranium-238, thus forming uranium-239. This unstable isotope eventually decays to become neptunium-239 which in turn decays to relatively stable plutonium-239. The entire process of decay requires only a few days (see figure 2). This type of reactor can also produce plutonium-240 in limited quantities; however, the plutonium-240 isotope cannot be used alone in a fission device. In fact, plutonium-240 tends to degrade the fission process because of its tendency to pick up another neutron (thus becoming plutonium-241) without fissioning. Unfortunately, plutonium (a mixture of plutonium-239 and plutonium-240) remains quite feasible when used as the core material for a small yield weapon (kilotons). The advantages of using plutonium as the fissionable material in a nuclear weapon are substantial. Extensive shielding is not required since plutonium-239, plutonium-240 and plutonium-241 emit only alpha particles and beta rays which have relatively insignificant penetration characteristics.¹¹ Therefore, during the period of the greatest danger to the perpetrators (the act of stealing this material), no shielding precautions

¹¹ Taylor, T. B. and Willrich, M., Nuclear Theft: Risks and Safeguards, p. 13, Ballinger, 1974.

PLUTONIUM PRODUCTION

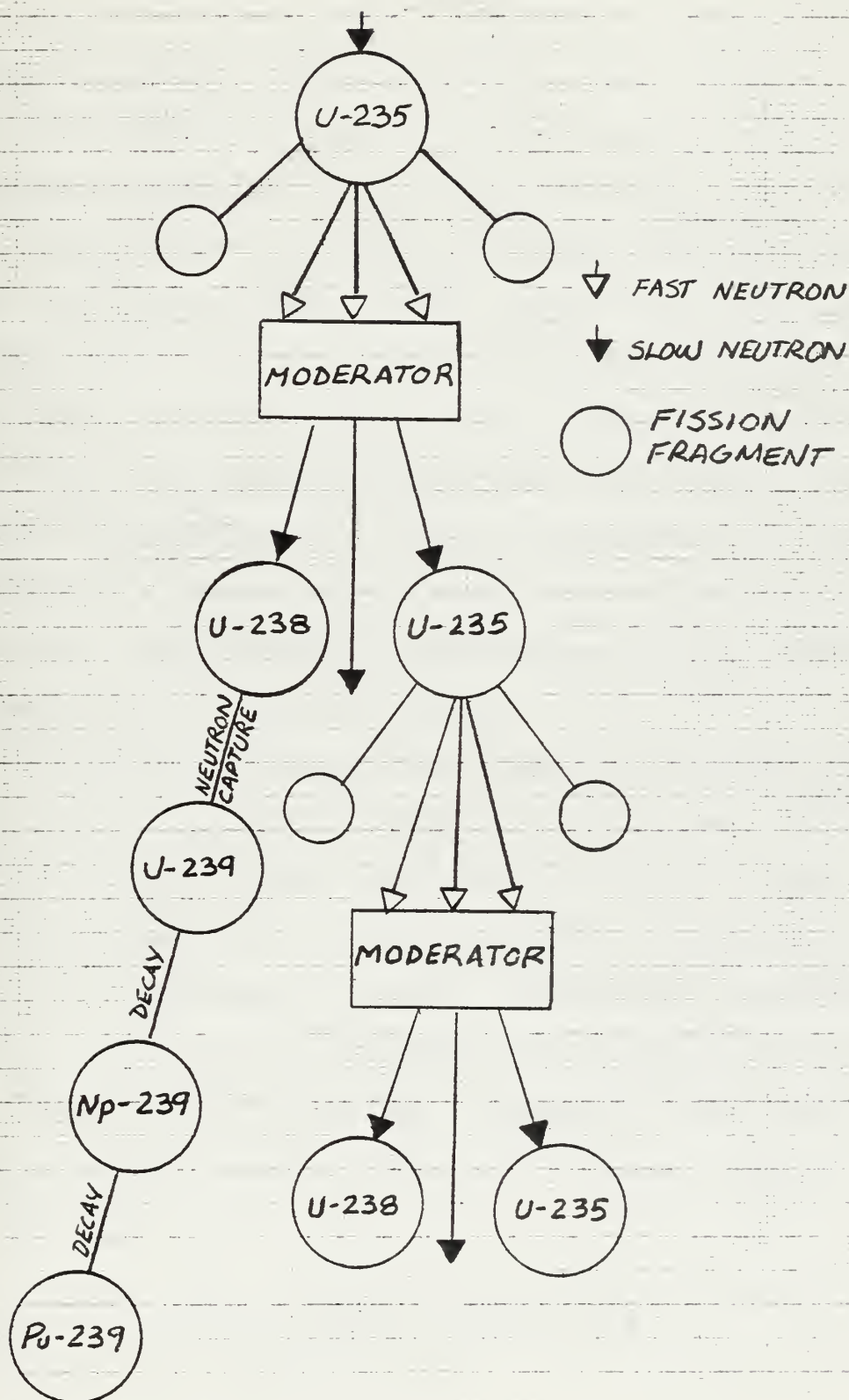


Figure 2

would be essential. Furthermore, only four to ten kilograms of plutonium are required to constitute a critical-mass, depending upon the chemical form, the type weapon and type of neutron reflector utilized in the weapon construction.¹² The disadvantages to using plutonium for the construction of a fission weapon are that when inhaled plutonium constitutes an extreme hazard. Minute amounts can cause death.¹³ Adequate protection is afforded by wearing mask-type filters and gloves. Any introduction of plutonium directly into the body (cuts, respiratory system) will cause grave problems.¹⁴ Another disadvantage to the use of plutonium as the core material of a fission weapon stems from the fact that plutonium-240 tends to fission spontaneously, thus introducing the possibility of predetonation.

In addition to the metallic forms of plutonium mentioned above, plutonium oxide and nitrate can be used to produce a nuclear fission device. Plutonium oxide can be used directly as the core material, and plutonium nitrate requires some additional refinement. However, the processes required are readily available in unclassified publications and do not constitute major problems for a chemist or other technically capable persons who would construct a weapon from this material.

¹² *ibid.*

¹³ Cohen, B. L., "Hazards in Plutonium Dispersal," P. 10, Institute for Energy Analysis, March 1975.

¹⁴ *Op. Cit.*, Taylor, p. 14.

B. URANIUM-235

Another source of fissionable material available as a result of the nuclear energy industry is highly enriched uranium (high concentrations of uranium-235). When compared with plutonium, uranium-235 in a relatively pure state (90%) provides an inefficient but workable fission core material. Uranium-235 is most frequently seen in its metallic, carbide or oxide chemical forms. All can be used directly as the core material of a fission device. Uranium hexafluoride, a gaseous form, is often used in the enrichment process. It is easily convertible to the metal or oxide form. The advantages of using uranium-235 stems from its relatively non-toxic qualities. No shielding or particular care in handling is required. Furthermore, unlike plutonium-240, uranium-235 does not release neutrons spontaneously in other than supercritical configurations, thus reducing the possibility that a home-made nuclear weapon would detonate prematurely. The disadvantage to using this isotope as the core material for a fission weapon lies in its inefficiency. If not pure or nearly so, many types of theft would be all but eliminated due to the size and weight of the required material.¹⁵

C. URANIUM-233

The final isotope to be discussed is uranium-233, the product of nuclear reactors which use thorium in the fission process. In the reactor core, neutrons bond with thorium-232

¹⁵ Enrichment beyond 20% is all that is technically required; however, tremendous quantities would be required to assemble a critical mass.

to form thorium-233. The decay of this substance results in protactinium-233 which again decays within four weeks or so to become the stable isotope uranium-233. Besides uranium-233, other isotopes are formed in this process--uranium-234 which acts similar to plutonium-240 and uranium-232.¹⁶ Uranium-232 decays further and in doing so emits gamma rays which are of concern to the handler. However, the quantities of gamma rays released are not so great as to be lethal without prolonged (days) exposure. Uranium-233 is similar to uranium-235 in many respects including the means of changing its state (nitrate, oxide, metallic). Unlike uranium-235, it is extremely efficient as a nuclear explosive material. In fact, only slightly more U-233 is required to form a critical-mass than is the case with plutonium. Its advantages stem from the fact that it is efficient and relatively non-toxic. Its disadvantage lies in the fact that U-232 is never separated in the nuclear fuel cycle. Consequently, shielding during periods of prolonged exposure is required.

¹⁶ Op. Cit., Taylor, p. 18.

III. FUEL CYCLE VULNERABILITY

It should be clear that any of the three fissionable materials discussed in the previous section (referred to as "special nuclear material") are suitable for use as the core material of a nuclear weapon.¹⁷ One of the most alarming prospects facing the United States (and indeed, the world) is the rapid increase in the quantities of special nuclear material (SNM) which will be produced by the nuclear power industry in the near future. As of March 1974, the AEC estimated that there was approximately 250,000 pounds of weapon-grade nuclear material in some phase of the nuclear fuel cycle. In one year's time, 346 individual shipments of SNM were made in weapon-size quantities (63,000 lbs).¹⁸ It is estimated that in 1975 alone the U.S. will produce 13,200 lbs. of plutonium.¹⁹ As a result of efforts to peacefully harness nuclear power, it is expected that the amount of available fissionable material will quadruple in

¹⁷ This study used the terms "special nuclear material" and "fissionable material" synonymously. Both terms refer to plutonium, uranium-233, or uranium enriched in the isotope 235 to a level greater than that found naturally.

¹⁸ Lanouette, W. J., "Homemade Nukes: Closer Than You Think," The National Observer, V. 39, p. 3, 16 March 1974.

¹⁹ Lotts, A. L., and others, "The Status of Thermal Reactor Fuel Manufacture in the United States," Peaceful Uses of Atomic Energy, V. 8, p. 201, 1972.

the next ten years and the current generation of light water reactors alone will produce 60,000 lbs. of plutonium per year.²⁰

In order to determine where the special nuclear material is most susceptible to theft, it is necessary to examine the U.S. nuclear fuel cycle. The nuclear fuel cycle is made up of the industrial operations required to generate electrical energy from a nuclear power reactor. It brings together a number of processes including uranium mining, milling, chemical conversion techniques, uranium enrichment, fuel fabrication, use in the reactor, and waste disposal.

A. HIGH TEMPERATURE GAS-COOLED REACTOR

There are three types of reactors that are of present and near term importance to the U.S. nuclear power industry. The high temperature gas-cooled graphite reactor (HTGR) contributes only about 0.33% of the country's nuclear power generating capacity, although this percentage should increase by a factor of ten by 1980. Even though there is only one active HTGR power reactor in the U.S.,²¹ the HTGR could be a significant future contributor to the overall nuclear theft problem because of the type of nuclear materials used and produced in the reactor core. The HTGR uses highly enriched uranium (90-95% uranium-235) in conjunction with thorium during the

²⁰ Phillips, J. G., "Energy Report/Safeguards, Recycling Broadens Nuclear Power Debate," National Journal Reports, p. 420, 22 March 1975.

²¹ "World List of Nuclear Power Plants," Nuclear News, V. 18, p. 63, August 1975.

fission process. Neutron capture by the thorium results in the production of uranium-233. This process is being studied intensely because the uranium-233 can be recycled. Uranium recycle, although economically advantageous, will have an unfavorable effect on the effort to adequately protect nuclear material. At the present time, however, the HTGR fuel cycle is "self protected" from theft because the uranium is highly diluted with graphite, and it is in a form difficult to convert into an explosive. Unfortunately, by 1980 production of HTGR fuels may differ in several important respects, making theft feasible.²² The most important difference may be the complete separation of uranium-235 and thorium, thereby making a small portion of the HTGR fuel cycle vulnerable to the theft of nuclear material directly useable in the core of a fission weapon.²³

B. LIQUID METAL FAST BREEDER REACTOR

The liquid metal fast breeder reactor (LMFBR) appears to be the U.S. nuclear power industry's choice as the power source of the future. Already having consumed over 1.8 billion dollars in research and development funds, an estimated 8 billion dollars will have been spent on this technology by the early 1980's yielding a potential 1.6 trillion dollar

²² U.S. Energy Research and Development Administration Report At (49-1)a- 3665, LDC Nuclear Power Prospects, 1975-1990; Commercial, Economic and Security Implications, Richard J. Barber Associates, Inc., 1975.

²³ Op. Cit., Taylor, p. 43.

economic benefit.²⁴ At the same time the "breeder" reactor will contribute vast quantities of plutonium to the SNM supply, thus further aggravating the problem of safeguarding nuclear material. The following excerpt from an AEC environmental impact statement should give the reader some insight into the scope of SNM proliferation problem in the not too distant future.

"Plutonium would come into increasing use with the ...introduction of the LMFBR. In the year 2020, about 550 LMFBR electrical generating stations (averaging 4000 MWe each), about 28 fuel fabrication plants, and about 28 reprocessing plants could be in operation. In the same year, there might be about 5000 metric tons of fissile plutonium present in the U.S. LMFBR fuel cycle, about half of which would be in the reactors. The extent of future plutonium product transportation between facilities would be strongly influenced by facility siting practices; assuming a dispersed industry, about 100,000 shipments (highway and rail) might be made in the year 2020."²⁵

As implied by its name, the LMFBR will be capable of "breeding" more fuel than it consumes in the fission process. By utilizing plutonium and natural or depleted uranium-238 (uranium with as little of the uranium-235 isotope as possible) as fuel in an unmoderated reactor core, more neutrons are captured by the uranium-238 than cause the plutonium fuel to fission. The result is the production of more plutonium-239 than is used up in the reactor.

²⁴ Facts on Nuclear Proliferation: A Handbook, Congressional Research Service Library of Congress, p. 185, U.S. Government Printing Office, December 1975.

²⁵ United States Atomic Energy Commission, Proposed Final Environmental Statement, LMFBR, V. IV, p. 7.4-1, December 1974.

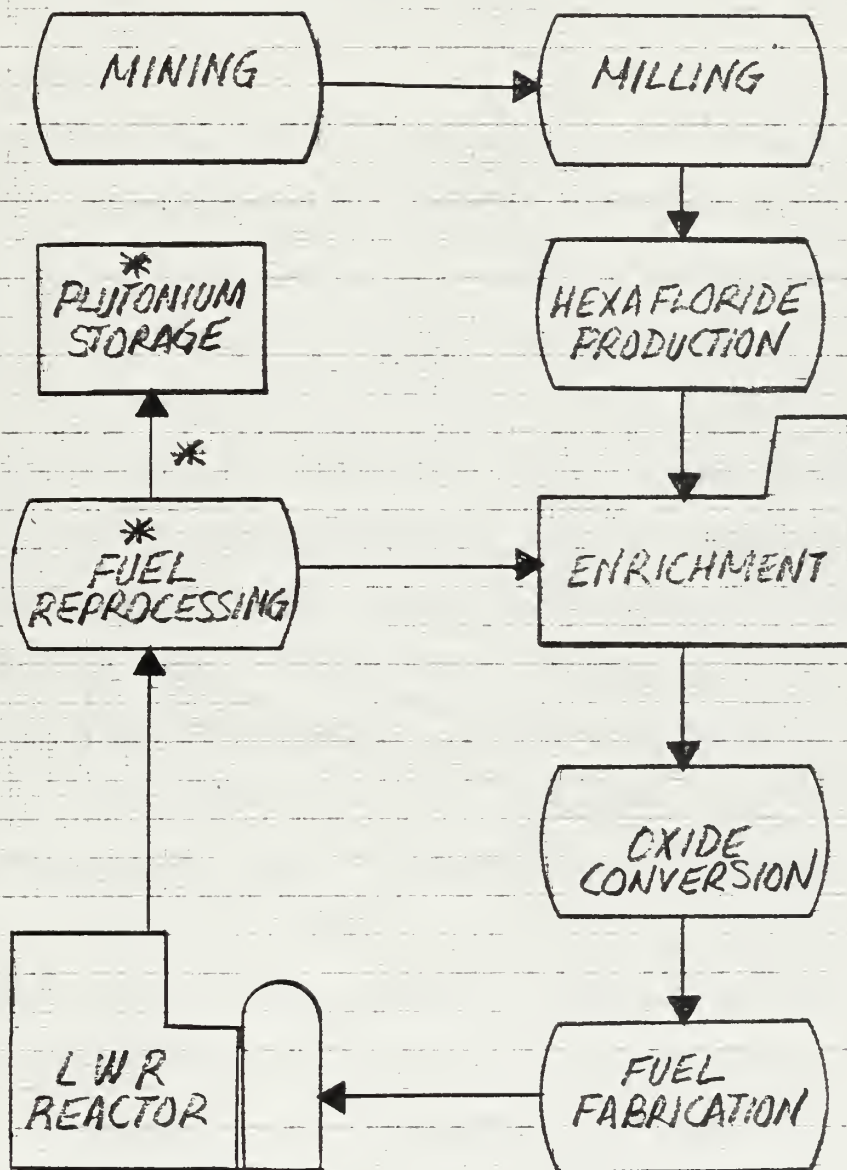
The fuel cycle for the breeder will remain uncertain for some time to come; however, it should be similar to the LWR plutonium recycle fuel flow with regard to vulnerability. Plutonium oxide should be available in strategic quantities during the final portion of fuel reprocessing, storage, the first phase of fuel fabrication and the transportation links which join these processes.

C. LIGHT WATER REACTOR

Although there are several types of reactors in use in the United States, the light water reactor (LWR) is by far the most numerous and is likely to remain so through the 1980's. In the interest of clarity it will be useful to develop a generalized LWR fuel cycle (see figure 3).

The LWR fuel cycle begins with the mining and milling of uranium ore. The product which leaves the milling site is called yellow cake or uranium oxide. The yellow cake is transported to a conversion plant which changes the uranium from a solid to a gaseous state (uranium hexafluoride) suitable for enrichment. The enrichment process takes place at a gaseous diffusion plant where the uranium hexafluoride is enriched to approximately 2-4% uranium-235. This level of enrichment is far too low to be used in a crude fission weapon. Once enriched, the uranium must be converted back to an oxide form. At the fuel fabrication plant the uranium oxide is molded into the small pellets which when combined make up fuel rods. Large numbers of these fuel rods are packaged into fuel assemblies for use in the reactor core.

GENERALIZED FUEL CYCLE FOR LIGHT WATER REACTORS (WITHOUT PLUTONIUM RECYCLE)



* POTENTIAL FOR THEFT

Figure 3

The fuel assemblies are shipped to the reactor site by truck in huge metal containers which may weigh from three to four tons. This fuel will usually be placed in storage at the reactor site while waiting for spent assemblies to be removed from the reactor.

During the process of irradiation in the reactor core, most of the uranium-235 will undergo fission, and at the same time quantities of plutonium-239 will be formed (uranium-238 will capture a neutron and decay to become the stable isotope plutonium-239). Some of this newly formed plutonium will also undergo fission. When the uranium-235 is depleted to less than 1%, the spent assemblies will be changed and after a "cooling" period at the reactor site the spent fuel will be shipped to the reprocessing plant (usually by rail). This fuel is now highly radioactive and must be shipped in gigantic containers which range in weight from about 25 to 70 tons. At the reprocessing plant the assemblies are allowed to cool further. Finally, the radioactive waste is separated from the plutonium and uranium through a chemical process. The depleted uranium must be returned to an enrichment facility since the uranium-235 now represents less than 1% of the total amount of uranium separated. The plutonium which is separated is in the form of a nitrate solution. When "plutonium recycle" commences, it will be converted to plutonium oxide, shipped to the fuel fabrication facility and used to form part of the fuel for the LWR. The conversion of

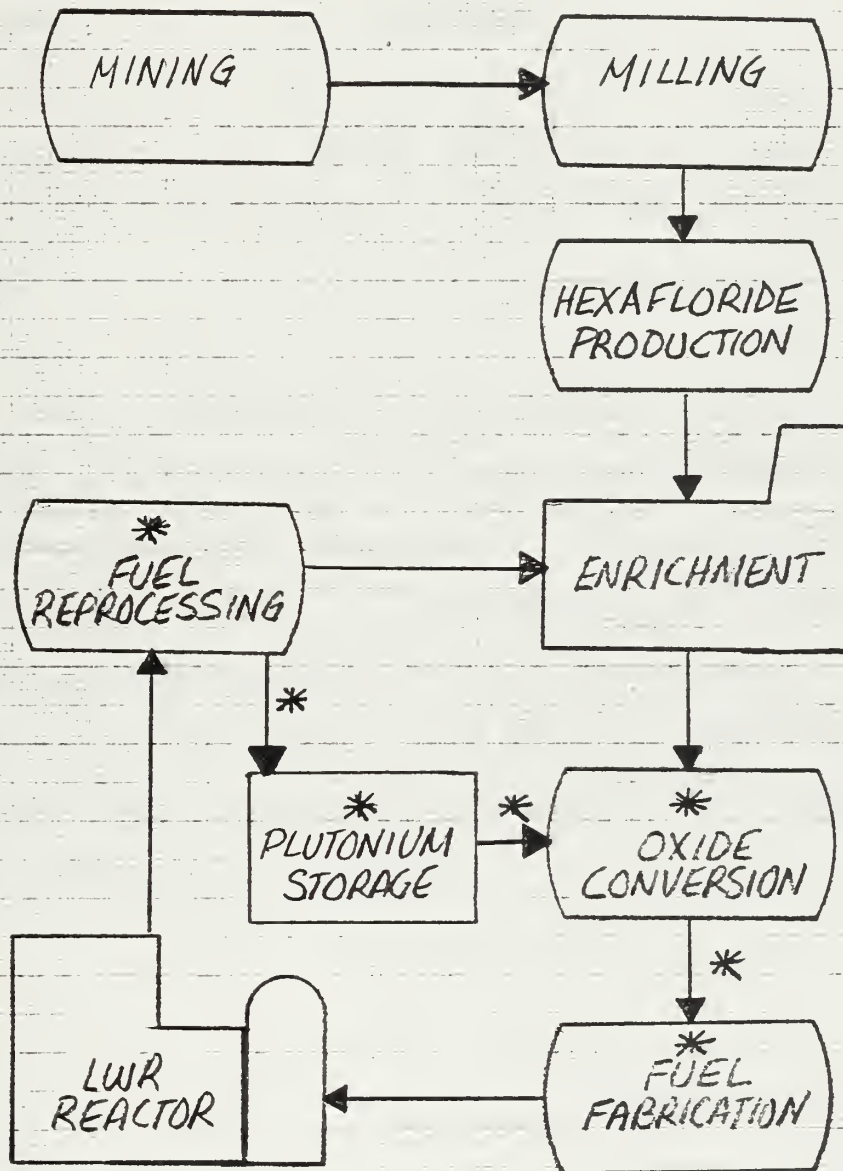
plutonium nitrate to oxide before shipment will serve to aggravate the safeguards problem because plutonium oxide can be used directly in a fission weapon and plutonium nitrate must be converted to a more appropriate form. However, this program has not yet begun and most of the plutonium produced thus far has been stored either at fuel fabrication plants or at special storage facilities.

An examination of the generalized fuel cycle presented in figure 3 reveals some salient features regarding the potentialities of theft of fissionable material from the nuclear power industry. The most obvious feature is that to a significant degree, during much of the fuel cycle the SNM is "self protected." During the mining, milling, production and enrichment portions of the LWR fuel cycle, the uranium-235 never constitutes more than about 4% of the uranium fuel (20% and above is considered weapons-grade). In fact, without plutonium recycling the only worrisky portions of the fuel cycle are in the final processes conducted by the fuel reprocessing plant, transportation to a storage facility, and at the storage facility itself. The reason for this is that before it becomes a part of the core of a light water reactor, there is no weapons-grade material available, and after its introduction to the reactor it becomes highly radioactive and is shipped in the massive containers mentioned previously.

However, as plutonium recycle becomes a part of the LWR fuel cycle, the portions of the cycle which are vulnerable

to theft will increase dramatically (see figure 4). The reasons for the increase in vulnerability are as follows. Plutonium now leaves the fuel reprocessing plant in the form of a nitrate solution. It is shipped in containers to a storage facility where it remains in liquid form. Plutonium nitrate cannot be directly used as the core material for a fission weapon; first it must be converted to an oxide or metallic form. Consequently, those who would steal plutonium nitrate would have to acquire the requisite laboratory equipment, techniques and take the proper precautions in order to complete the conversions themselves. (The fact that the plutonium is in an inconvenient form may or may not hinder the illicit development of a nuclear weapon. This would strictly be a function of the adversary's resources and capability.) On the other hand, when plutonium recycle begins on a large scale, plutonium will probably be converted to an oxide form at the reprocessing plant. Plutonium oxide can be used directly as the core element of a nuclear weapon. The reasons this conversion will be made are primarily due to the requirements of the fuel fabrication plant which use plutonium oxide to form the fuel pellets, but it has been suggested that from a safety point of view oxide presents less of a spillage problem should there be an accident in transit. The result is that sizeable quantities of plutonium in a form which can be used directly as the core material of a nuclear weapon will have to be shipped from reprocessing plants to fabrication plants. With the advent of plutonium

GENERALIZED FUEL CYCLE FOR LIGHT WATER REACTORS (WITH PLUTONIUM RECYCLE)



* POTENTIAL FOR THEFT

Figure 4

recycle, the portions of the fuel cycle most vulnerable will include the later stages of fuel reprocessing, shipment to a plutonium storage area (if required), the plutonium storage area, shipment to the fuel fabrication plant, and the process of fuel fabrication. This increase in the use and availability of plutonium has caused considerable clamor. Anti-nuclear power groups around the country have seized upon the plutonium recycle issue to arouse public and governmental interest in the overall expansion of the U.S. nuclear power program. The consequence of this interest is yet to be fully determined; however, there have been some concrete examples of the effectiveness of these groups. The two most notable examples are the creation of ERDA and the NRC to replace the Atomic Energy Commission and the California Nuclear Initiative which will be on the June 8, 1976 ballot. One possible outcome of that ballot could be to seriously limit the growth of nuclear power in California.

IV. WEAPON CONSTRUCTION

Given that the desired fissionable material is available in the appropriate form and quantity and that it is susceptible to theft, what are the possibilities for constructing a crude fission bomb or even a radiological dispersal device? There is wide variation among the experts as to just how "easy" either undertaking would be, but the important point is that most agree it can be accomplished by non-national groups and organizations. There are several reasons for this consensus. The first and perhaps most important reason is that there has been widespread publication of precise instructions pertaining to the construction of nuclear weapons, conversion of plutonium and uranium to metal forms, associated safety precautions and the like. An example of the type and depth of information available to an illicit design team is taken from an ARPA study prepared for the Defense Supply Service.

"[Special nuclear material] is generally not in metal form but must be converted into metal with the physical shapes and dimensions that are required by the device designed; however, this task can be done. The technology of all necessary chemical conversion processes has been described in significant detail in the unclassified literature. Two compendiums would be especially useful for the production team. These are Reactor Handbook, Second Edition, Revised & Enlarged, Interscience Publishers, Inc., New York, and Plutonium Handbook, A Guide to the Technology, O. J. Wick, ed., Gordon & Breach, New York, 1967. The Reactor Handbook has information (theory and experimental data) on common materials useful in device construction (graphite, steel, beryllium, and so forth),

shielding, neutron transport, nuclear constants, critical experiments, manufacture of neutron sources, and techniques of radiation protection as well as detailed information on the processing of uranium and plutonium.. The Plutonium Handbook has information on chemistry and chemical processing of plutonium, its metallurgy, its fabrication (casting, extrusion, rolling, swaging, welding, machining) and health and safety, including designs of safe facilities. The sabotage group would apparently not need to engage in much of a research and development program. In these and other readily available documents, it has been spelled out for it in detail and for almost all process steps the reagents, temperatures, and other information necessary for efficient production. It would need only to select, procure, and install equipment and to conduct a brief series of shake-down runs."²⁶

Another cause for concern is that a growing number of people have now worked closely with the design, development, production and operation of nuclear weapons. In fact, "the number of persons worldwide who are considered to have the technical expertise necessary to manufacture a crude nuclear bomb is estimated to be in the tens of thousands."²⁷ Consequently, there are a number of qualified persons who feel that the construction of a crude nuclear device is well within the capabilities of a few persons and possibly even one person (this has reportedly been accomplished by an MIT graduate student). Two noted authors in the field have made the following assessment of the skills and non-nuclear resources required to fabricate a nuclear weapon:

²⁶ Advanced Research Projects Agency Report 1141, The Unconventional Nuclear Threat - A preliminary Survey (U), by E. M. Kinderman, T. B. Taylor, and W. R. Van Cleave, p. 83-84, Secret, May 1969.

²⁷ Jenkins, B., Will Terrorists Go Nuclear?, Rand Corporation, p. 3., May 1975.

"As a result of extensive reviews of publications that are available to the general public and that relate to the technology of nuclear explosives, unclassified conversations with many experts in nuclear physics and engineering, and a considerable amount of thought on the subject, we conclude:

Under conceivable circumstances, a few persons, possibly even one person working alone, who possessed about ten kilograms of plutonium oxide and substantial amount of chemical high explosive could, within several weeks, design and build a crude fission bomb. By a "crude fission bomb" we mean one that would have an excellent chance of exploding, and would probably explode with the power of at least 100 tons of chemical high explosive. This could be done using materials and equipment that could be purchased at a hardware store and from commercial suppliers of scientific equipment for student laboratories.

The key persons or person would have to be reasonably inventive and adept at using laboratory equipment and tools of about the same complexity as those used by students in chemistry and physics laboratories and machine shops. They or he would have to be able to understand some of the essential concepts and procedures that are described in widely distributed technical publications concerning nuclear explosives, nuclear reactor technology, and chemical explosives, and would have to know where to find these publications. Whoever was principally involved would also have to be willing to take moderate risks of serious injury or death.

Statements similar to those made above about a plutonium oxide bomb could also be made about fission bombs made with high-enriched uranium or uranium-233. However, the ways these materials might be assembled in a fission bomb could differ in certain important respects.

We have reason to believe that many people, including some who have extensive knowledge of nuclear weapon technology, will strongly disagree with our conclusion. We also know that some experts will not. Why is this a subject of wide disagreement among experts? We suspect that at least part of the reason is that very few of the experts have actually spent much time pondering this question: 'What is the easiest way I can think of to make a fission bomb, given enough fission explosive material to assemble more than one normal density critical mass?' The answer to this question may have little to do with the kinds of questions that nuclear weapon designers in the United States, the Soviet Union, the United Kingdom,

France, or Peoples Republic of China ask themselves when they are trying to devise a better nuclear weapon for military purposes. But the question is likely to be foremost in the mind of an illicit bomb maker.

Whatever opinions anyone may have about the likelihood that an individual or very small group of people would actually steal nuclear materials and use them to make fission bombs, those opinions should not be based on a presumption that all types of fission bombs are very difficult to make."²⁸

A. METHODS OF BOMB CONSTRUCTION

One of the fundamental problems associated with the development of a nuclear weapon is to bring two or more sub-critical masses of fissionable material together to form a super-critical mass, or to compress a sub-critical mass to a point necessary to achieve super-criticality. Furthermore, the material must be brought together or compressed very rapidly, and it must remain in a super-critical configuration for as long as possible. In order to accomplish the super-critical formation of fissionable material, at least two basic geometries have been employed.

1. Gun Geometry

Gun-type geometry is the most elementary method of configuring a super-critical mass of fissionable material. Since it is also the least efficient method, it would appeal to the group or individual that had a large quantity of fissionable material but very little complementary talent or experience. Gun geometry physically separates two

²⁸ Op. Cit., Taylor, p. 20-21.

sub-critical masses of fissionable material. When detonation is desired, one mass is fired down a guide-tube at a second, stationary sub-critical mass surrounded by tamper. Usually both impact surfaces are coated with elements which, when they meet and mix, release a pulse of neutrons that assure initiation of the chain reaction.²⁹ (See figure 5).

2. Implosion Geometry

The implosion method of weapon construction is a much more efficient design than the gun geometry, but it also demands much more sophistication on the part of the design team. The implosion geometry uses a sphere of fissionable material surrounded by a tamper which is in turn surrounded by a sphere of high explosives. Initiators, which are placed at the center of the core, become mixed when the core is compressed. The compression of the core and tamper is achieved by the formation of an inwardly produced shock wave. The shock waves, which are formed by the detonation of the spherically-shaped explosives, must arrive at the core simultaneously to achieve the required compression. An encyclopedia article by Joyn S. Foster describes the process:

"A simple picture of this so-called implosion technique can be gained by imagining a sphere of fissionable material and tamper which is slightly below critical. Under these conditions, a neutron born in the central region of the fissionable material has almost an even chance of producing a fission before it leaves the metal. If the assembly is now compressed to twice the original density, the radius is then reduced to about 8/10 of its initial value. A neutron leaving the central region under the compressed

²⁹ Glasstone, S., Sourcebook on Atomic Energy, 3rd ed., p. 530-533, D. Van Nostrand, 1967.

PRINCIPLES OF A GUN GEOMETRY WEAPON



Figure 5

conditions must pass through atoms which are more closely spaced by a factor of two, although the total distance is reduced only 20 percent. Consequently, the chance of causing a fission is actually increased by approximately 2×0.8 , or 1.6 times. The assembly is now obviously very supercritical, although only one critical mass was used.

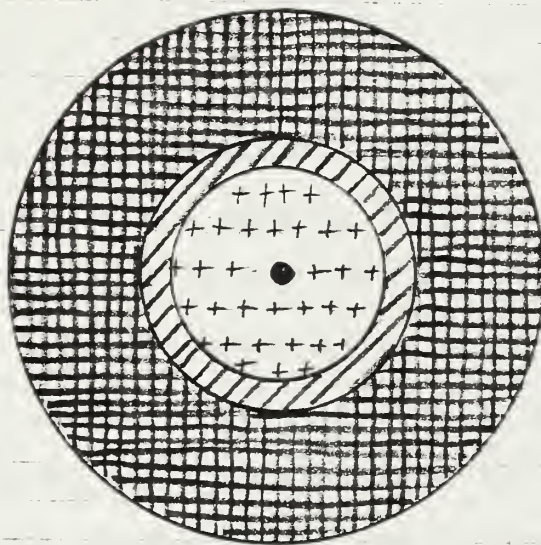
The trick, of course, is to compress to several times normal density the mass of fissionable material and tamper. This requires pressures above 10 million pounds per square inch. Such pressures can be developed through the use of high explosive. The nuclear core could be placed in the center of a large sphere of high explosive. Compression of the fissionable material is attained by lighting the outer surface of the high explosive simultaneously at something like 100 points spaced roughly evenly over the surface. The procedure produces a roughly spherical, in-going detonation wave which, on striking the metal core, provides the necessary compression to lead to a nuclear explosion."³⁰ (See figure 6).

3. Comparison of Methods

The differences between the gun and implosion design lead to some important tradeoffs which would profoundly affect the capability of certain groups to construct nuclear weapons. As mentioned previously, the gun geometry is a relatively simple design requiring very little in the way of sophisticated design practices. The price which is paid for design simplicity, however, is inefficiency. Consequently, the group plagued with a lack of resources (money) and talented membership in weapon construction would ostensibly be forced to adopt the gun geometry design. As a result, the risk involved to the group would probably go up because of the larger quantity of SNM required. On the other hand, a group or individual with either resources or an abundance of talent

³⁰ Foster, J. S., "Nuclear Weapons," Encyclopedia Americana, V. 20, p. 520-522, Americana Corporation, 1973.

PRINCIPLES OF AN IMPLOSION GEOMETRY WEAPON



HIGH EXPLOSIVE



TAMPER



FISSIONABLE MATERIAL



INITIATOR

Figure 6

has the best of both worlds; the implosion technique would require less fissionable material and achieve a higher explosive yield at a lower level of risk.

B. RADIOLOGICAL WEAPONS AND DISPERSAL DEVICES

Little time will be devoted to the discussion of radiological weapons and dispersal devices because they use SNM so ineffectively. Although a rather insidious radiation weapon could be fashioned with less than a kilogram of SNM, and a few grams of plutonium dispersed in the air-conditioning system of a large office complex could kill or injure hundreds and leave the building useless for a prolonged period, there are less risky and more destructive means of accomplishing similar ends. In fact, "arson, scattering of chemical or biological poisons, or chemical explosive could produce equal or more destructive effects, in many cases, with less effort."³¹ Furthermore, if a group possessed, for example, a kilogram of plutonium, it could very likely be sold for enough money to fund many acts equally destructive to society. Or the material could be used to make a nuclear threat more credible. For example, the "_____ Liberation Army" could research the available unclassified literature in order to formulate a credible nuclear weapon design consistent with the grade of plutonium it possessed. A copy of the design and a sample of the plutonium could then be sent to the Governor of California requesting two million dollars in small bills and

³¹ Willrich, M., ed., International Safeguards and Nuclear Industry, p. 191, Johns Hopkins University Press, 1973.

air transportation out of the country. If the demands were not met, the group could threaten to detonate an (actually non-existent) nuclear weapon in downtown Los Angeles, San Diego, Sacramento or San Francisco.

Even though it does not seem logical that an organization or group would steal plutonium or other radioactive material for the purpose of constructing a radiological weapon or dispersal device, a well thought out plan may include using the material in this manner, i.e., hold the material hostage in the event that the group was caught in the act. For example, upon stealing plutonium from a storage area, one of the first acts undertaken by the thieves may be to attach high explosives to the plutonium containers. In this manner, the group has something to bargain with if they are compromised by law enforcement officials during the commission of the theft. The extent of their bargaining power would probably depend on many factors, the foremost of which would be the population density in the surrounding area. One can imagine some circumstances under which their original demands would be met even though the plot had not been fully carried out.

V. PRIMARY METHODS OF SAFEGUARDING FISSIONABLE MATERIAL

A. OVERVIEW

The primary objective of the nuclear safeguards program is to protect the public from injury, death or property damage as the result of the theft of special nuclear material. To do this, the Nuclear Regulatory Commission must be concerned with the prevention, detection, recovery, and response to the theft of nuclear material. Along these lines, the Commission has undertaken a "federal security agency" study which was mandated by the Energy Reorganization Act of 1974. The purpose of the study is to assess the need for, and feasibility of, creating a federal security agency which would be charged with the safeguarding of special nuclear material. Although the study has not been completed at this time, it does not appear that the creation of a federal security force will be requested of Congress. If this is, in fact, the outcome of the study, the Commission will again be confronted by critics of the nuclear power program who feel that not enough is being done in the safeguards area.

The previous examination of the nuclear fuel cycle revealed three major avenues of theft available to those with the requisite motivation and resources: nuclear diversion, theft against storage facilities, and nuclear hijacking.

B. DIVERSION

Nuclear diversion, as the term is used here, implies that the theft is clandestine. In this situation an employee (or some other person with access to fissionable material) of a fuel fabrication plant or reprocessing facility would conspire with others or act alone to smuggle small quantities of nuclear material from the plant/facility over a period of time. Under the present system of safeguards, material control and accountability are the key deterrents to diversion. Material controls refer to those measures undertaken by the plant or facility to ensure that the SNM remains within the controlled area, i.e., it is not smuggled out by an employee. The chief means of material control are plant surveillance techniques, restrictions which limit access to SNM to authorized persons only, personnel searches at exits from controlled areas, and the use of electronic devices at controlled area exits which are able to detect minute amounts of SNM. In the latter case, electronic inspections are made of all persons exiting a material access area. "The [NRC] Regulatory Guide suggests that the detection equipment used should be capable of detecting 0.5 grams of 90% enriched uranium, shielded in each case by brass and concealed anywhere on a person's body."³² The consequence of this regulation is significant. If the diversion were attempted by one individual, it would take him on the order of 8,000 - 20,000 exits to assemble a

³² Op Cit., Taylor, p. 93

critical-mass of plutonium, and each day he would be risking detection. One other drawback to these safeguarding regulations is that the means of inspecting vehicles that must enter controlled areas is not prescribed. The NRC has left the precision with which a vehicle is searched up to each licensee. Since a critical inspection of each vehicle and packages within the vehicles may take an inordinate amount of time, a licensee may be inclined to allow cursory inspections.

Accountability is the other prime method used to deter the diversion of special nuclear material. Accountability (material accountancy) is based on three practical measures. Physical inventory, the first, is simply the measurement of nuclear materials on hand at a given point in processing. Usually this is the amount of material received in shipment. The second measurement is referred to as materials unaccounted for (MUF). This is the difference between the amount of material that underwent processing at the outset (physical inventory) and the material obtained in the final inventory, plus or minus additions or removals. The final measurement is the statistical construction of a confidence interval (goodness of fit) to determine the reliability of the MUF. The licensee is then required to keep precise records which accurately document the quantities of material being processed, that which has been transferred, etc. In the case of the chemical reprocessing plants, the limit of error on material unaccounted for (LEMUF) is 1.0% for plutonium and uranium-233 and .7% for uranium enriched in the U-235 isotope; .5% is the

limit of error for materials in other facilities.³³ The impact of these regulations has been dramatized repeatedly in the past. A Kerr-McGee conversion plant employee stated that in the past the company had on several occasions been unable to account for as much as 60 pounds of plutonium.³⁴ In 1966, a plant in Apollo, Pa. was unable to account for 220 pounds of enriched uranium.³⁵ "Theoretically, at least 2,500 pounds of special nuclear material could have disappeared from licensees' inventories already without being detected."³⁶ The problems that the MUF process has caused are twofold. In the event of a real threat or a hoax, the Nuclear Regulatory Commission would most likely be unable to deny the likelihood of fissionable material in the hands of the perpetrators. This inability could be of tremendous significance during a bomb threat or ransom demand situation.

The obvious drawback to material accountancy is that while it may serve a beneficial deterrence function, it does very little to detect the thief who was not deterred. The Rosenbaum study concluded that "it will be necessary to direct the accountability effort not toward computing an overall balance as it now is, but toward the detection of diversion. We recommend that the current concepts of MUF and LEMUF be abandoned

³³ Op. Cit., Lanouette, p. 3.

³⁴ Burnham, D., "U.S. Says Lost Plutonium is 'Only Small Amount,'" The New York Times, p. 54, 3 January 1975.

³⁵ *ibid.*, p. 54.

³⁶ Op. Cit., Lanouette, p. 3.

as a basis of safeguards and that they be replaced by a different kind of accounting and measurement system..."³⁷

C. THEFT OF FISSIONABLE MATERIAL FROM STORAGE AREAS

The nuclear material storage area is another vulnerable portion of the nuclear fuel cycle. Here, we include temporary storage areas associated with fuel fabrication and reprocessing plants in addition to areas used strictly for storage. In some studies of theft in the nuclear industry the vulnerability of storage areas has been underestimated. Perhaps the primary reason for this lack of attention stems from the fact that there are a number of NRC safeguards required of each storage facility. But while there are safeguards required, there are also enough ambiguities within the regulations to render these measures ineffective under some circumstances.

Basically, the physical security regulations can be summarized as follows. All plants that wish to be authorized to hold strategic quantities of nuclear fission materials must propose a physical security plan which conforms to the NRC physical protection requirements. Each plan is therefore individualized by each licensee. All approved plans are held confidentially and not released to the public or competitors. Several of the more important NRC requirements have been listed below:

- Double barriers to access (fences)
- Access controls (monitored gate)
- Entry and exit searches
- Intrusion alarms

³⁷ United States Atomic Energy Commission, Special Safeguards Study [The Rosenbaum Report], Rosenbaum, D. M., and others, p. 3, April 1974.

- Trained and armed guards
- Communication capability with local law enforcement agencies
- Theft response plan

All of these listed requirements must be included in the licensee's physical security plan. Fissionable nuclear material is to be housed within a concrete, steel or brick building referred to as a "material access area." When this area is unoccupied it must be alarmed with electronic equipment. Fissionable material not "in process" must be housed in a vault-like room.³⁸ Since "in process materials" are not specifically defined, the criteria for what material must be vaulted and what can be left out is ambiguous. Around each material access area is a "protected area." This barrier is designed to serve as a buffer. It must be enclosed by an eight-foot fence with barbed wire strung around the top. All gates are required to be equipped with alarm systems. The outer perimeter of the fence is to be buffered by an "isolation zone" which amounts to an unpatrolled area of unrestricted view, thus depriving potential thieves of a hiding place immediately adjacent to the fence. (See Appendix B).

The plant must form a security protection force made up of guards (armed), patrol watchmen (can be armed in emergencies), and/or watchmen (unarmed). It is noteworthy that until recently the AEC (now the NRC) did not prescribe the size, physical requirements, training or equipment of the force. Furthermore, it did not delineate overall organizational standards

³⁸ A vault-type room is defined as a room with locked doors and an alarm system to detect entry.

or the gamut of possible threats against which the security organization might expect to be confronted. Each guard or watchman was to have some method of communication with a central alarm center which was to be continuously manned. The center was to be capable of dispatching a reserve force and alerting local law enforcement officials of the situation. In order to achieve communication with the local law enforcement group, the center was to be equipped with a telephone and two-radio radio communications.

In November of 1973, the AEC issued regulations which are essentially still in effect except for several revisions. Although there is still no size requirement, the new regulations prescribe how the licensee's guards and watchmen are to be trained, equipped and qualified. Furthermore, the Commission made the following statement concerning the scope of training and the potential threat:

"The general training program should be adequate to help assure that the licensee's guards and watchmen are capable of providing protection of the facility against sabotage or SNM from theft, either in transit or at a fixed site, until arrival of assistance from law enforcement authorities. The following potential sources of threats should be considered in the training program:

a. Lone individuals familiar with the construction and operation of the facility or the routing of vehicles transporting SNM;

b. A group of several individuals, some of whom may be armed with weapons such as rifles, sidearms, and explosives;

c. A group of unarmed individuals engaged in disorderly conduct or mob activities."³⁹

³⁹ United States Atomic Energy Commission, Regulatory Guide "Training, Equipping, and Qualifying of Guards and Watchmen," V. 5.20, p. 4, January 1974. (See Appendix C).

In addition to more or less defining the goals of training, a ten-day general training program, a three- to five-day facility or carrier training programs and an arms qualification program are included. In April 1975, these programs were expanded slightly to give greater emphasis to the "Points of Law" and "Security Skills" sequence. Table I shows the general increasing level of protection afforded special nuclear material since 1973.

Nevertheless, many critics of the Commission continue to find the regulations lacking. For example, the threat statement quoted above differs markedly from most evaluations of the maximum credible threat. In the case of the Rosenbaum Safeguards Report, a study contracted by the AEC, it was estimated that "the maximum credible threat to any facility or element of transportation handling special nuclear materials is fifteen highly trained men, no more than three of which work within the facility or transportation company from which the material is to be taken. We believe that the 'insiders' can include anyone up to the higher levels of management of the organization involved." Quite obviously, there is an order of magnitude difference between the size of the force projected by the Nuclear Regulatory Commission and the force projected by the Rosenbaum Report. There is also considerable discrepancy between critics and the Commission

⁴⁰ Larson, H. J., "Pivotal Safeguard Issues Viewed by the NRC," paper presented at the Institute of Nuclear Material Management 1975 annual meeting, New Orleans, LA, 20 June 1975.

⁴¹ U.S. Senate Committee on Government Operations, Peaceful Nuclear Exports and Weapons Proliferation, A compendium, p. 472, April 1975.

INDICATIONS OF GROWTH IN THE U.S. NUCLEAR SAFEGUARDS PROGRAM

REQUIREMENTS OCTOBER 1973		REQUIREMENTS APRIL 1975	
Physical Security at Licensee Plants	Fence Locked vaults Intrusion alarm or 4-hour	Double barriers Access controls Entry/exit search Intrusion alarms Trained and armed guards Communication with local law enforcement agency Response to attempted theft	Special design vehicle or armed escorts Monitoring of transfers Radiotelephone on trucks 2-hour call-in to control point Preplanned route and delivery time
	Hand-to-hand receipts		2 to 6-month inventory based on measurements Measurement quality assurance LEMUF limits MUF constrained by LEMUF Item identification Tamper-safing
Physical security in Transportation			
Material Control and Accounting	6 to 12 month inventory MUF Constrained by LEMUF		

Table I

regarding the type of equipment thieves would use. The Regulatory Guide fails to mention the possible use of silencers, automatic weapons, light anti-tank weapons and other weapons which are becoming relatively common to the underworld and are quite a bit more sophisticated than "rifles and side-arms."

Furthermore, the training program does not provide scenarios for diversion or possible methods persons might use to conceal special nuclear material. No classes are given on illicitation, intelligence gathering capabilities of an opposing force nor are there training periods required with the shotgun and rifle.

Other criticism stems from the overall generality of the guidelines. With the exception of the "Arms Qualification Program," the licensee is free to interpret the Regulatory Guide as he sees fit. Consequently, the licensee could implement a dynamic, aggressive security force, or he could choose to take numerous shortcuts which would meet requirements but result in an ineffective security force. Some critics would argue that the problems which beset this entire group of fixed site safeguards stem from a lack of specific regulations forcefully implemented by the Nuclear Regulatory Commission. A dramatization of how lax safeguards procedures can become is demonstrated by the example of a plutonium storage facility isolated in a wooded area of upstate New York:

"The facility is a steel, windowless, rectangular building about 80 by 160 feet. It is surrounded by a chain link fence that is seven feet high and about fifty

feet from the building exterior. Trucks carrying shipments of plutonium pull into an unloading dock inside the building. There workers unload the shipping containers with the help of a small crane. They remove the steel-jacketed plastic containers, each containing 2.5 kilograms of plutonium in solution, and insert them into special storage containers... Outside normal working hours, there are no individuals at the site. The building and some of the interior points, however, have alarms designed to send signals to a central point in the general vicinity of the site. ASDA [New York State Atomic and Space Development Authority] officials have expressed confidence that armed law enforcement authorities would appear at the facility within 'a very short time' [after the alarms have been sounded]."⁴²

Given that the electronic alarm works and is not by-passed by the intruders, and that a small law enforcement contingent is alerted, would they be a match for a dozen organized terrorists with automatic weapons and a good plan?

D. NUCLEAR HIJACKING

The protection of special nuclear material in transit has particular importance to this discussion because it is widely regarded as offering the most potential for the theft of fissionable material. Nuclear shipments are most vulnerable during the period when they are transported from the fuel reprocessing plants to the fuel fabrication plants. During this period the nuclear material is generally in a form which is either directly useable in the core of a fission device, or it is at least easily converted to an appropriate form. In addition, it is relatively light and poses no great radiation hazard. The methods used for transportation are rail, truck, air and sea. The methods of transportation most

⁴² Op. Cit., Taylor, p. 37.

pertinent to this discussion are truck and air, although rail and sea should not be discounted altogether as potential areas of theft. No doubt British Rail Officials felt that rail security measures were very effective against theft until one of its trains arrived at its destination on 8 August 1963, seven million dollars lighter. Or in the case of shipping, it would not be too difficult to imagine a ship being hijacked by a crew which is made up almost entirely of third world nationals. Since the ship carrying SNM need not be U.S., this particular possibility is even more believable.

On the other hand, rail and sea methods of transportation present serious obstacles to a group of hijackers. Both restrict the variety of "getaway techniques" that can be used, and both would usually demand that the fissionable material be transferred from the original carrier soon after the seizure.⁴³ Although immediate transfer of the material may not be much of a burden, it tends to reduce the alternatives available to the thieves.

The hijacking of special nuclear material while being transported by truck presents a very serious problem in the

⁴³ It is easy to imagine that if a plane or truck carrying fissionable material were hijacked, the adversaries might decide to use the carrier as the escape vehicle. The material would not have to be removed until a "safe house" or "safe area" was reached. However, if a train is to be used as the escape vehicle, thieves are restricted to the original direction of travel and, of course, to the tracks themselves. This would seem to demand that the material be physically removed from the train (unless the object of the theft was to hold the SNM hostage). In the case of a ship, the thieves are restricted in speed and, worst of all, they could be easily targeted by law enforcement officials.

United States. There is little question that most government and industry officials regard this transportation link as the weakest in the nuclear fuel cycle. The substantiations for this conclusion are fairly obvious. It is no secret that hundreds of commercial carriers are hijacked each year. These thefts have resulted in the loss of an estimated 1.2 billion dollars worth of material goods. The role of organized crime in the trucking industry and its labor union has been widely publicized and well documented.

In an effort to counter this threat, the Nuclear Regulatory Commission has implemented a series of regulations which are designed to provide "assurance that a theft cannot be successfully carried out short of a significant armed attack."⁴⁴ Exactly what is meant by a "significant armed attack" is apparently clarified by Appendix C, discussed previously, i.e., "A group of several individuals, some of whom may be armed with weapons such as rifles, sidearms and explosives." Again, it should be pointed out that this estimate of the maximum credible threat is in sharp contrast to the Rosenbaum Report, among others.

Licensees who presently wish to ship strategic quantities⁴⁵ of SNM by truck must insure the security of the nuclear material. It is interesting that the trucking firm itself need not be licensed by the NRC. Specific regulations pertaining to shipment by road can be summarized as follows: All shipments

⁴⁴ Op. Cit., Taylor, p. 94.

⁴⁵ Strategic quantities is defined as 5 Kgs uranium-235 (20% enriched or greater) or 2 Kgs uranium-235 or plutonium.

by road must be direct and the route must be preplanned. There can be no intermediate loading or unloading. Trucks must carry a radiotelephone and are required to communicate frequently (two to five hours) with the licensee or his agent. There must be two persons in the vehicle with the shipment, either two drivers or one driver and one other authorized person. Physical protection of the truck can take one of two forms. The first method is to have two persons in a vehicle designed to "permit immobilization of the van and provide barriers or deterrents to physical penetration of the cargo compartment."⁴⁶ The alternative method is to utilize an armed escort consisting of two guards in a separate vehicle. Escort vehicles are also equipped with radiotelephone capable of continuous radio communication with the van. There is one potentially significant exception to these methods. If the shipment requires an average time of one hour or less, only a driver is required in the vehicle containing special nuclear material.

Taylor and Willrich point out that the first method does little to deter an employee theft and the second method does little to deter a non-employee theft since the armed escort could be intercepted before the hijacking took place.⁴⁷ The communication requirements tend to increase the problem for

⁴⁶ United States Nuclear Regulatory Commission, Rules and Regulations, Title 10 CFR, Part 73, "Physical Protection of Plants and Materials," Section 73.31.

⁴⁷ Op. Cit., Taylor, p. 96.

a potential thief; however, these requirements do little more than demand that the hijackers rehearse their procedures and execute the plan swiftly. And if the thieves have been able to obtain the proper radio frequencies, any communication could prove advantageous to the thieves.

Many authors of publications which address the problem of nuclear theft have minimized the problem of hijacking a nuclear cargo when transported by air. Presumably, this is because there are stringent safeguards which apply to the shipment of SNM in a passenger aircraft.⁴⁸ Cargo aircraft, on the other hand, are almost totally unregulated when the entire flight is intended to remain in the continental United States. The only regulations which apply are those concerning the transfer of nuclear material. During a scheduled transfer of SNM or when some other material in the same cargo compartment is being transferred, a guard must be present to insure that the SNM is properly routed. Otherwise special nuclear material need not be escorted when the cargo flight plans to remain within the United States. There are, in fact, no physical protection requirements to safeguard nuclear material while in an air transit status. Furthermore, there is no screening of crews, and there is no specification as to what types of aircraft may be used.

⁴⁸ Op. Cit., 10 CFR part 73, Section 73.32, "No shipment of special nuclear material shall be made in passenger aircraft in excess of (1) 20 grams or 20 curies, whichever is less, of plutonium or uranium-233, or (2) 350 grams of uranium-235."

1. Assessment of Transportation Safeguards

Although this presentation of the Nuclear Regulatory Commission's efforts to safeguard nuclear material has emphasized some of the shortcomings of that program, commendable safeguarding efforts have been initiated in the recent past and others are in the public comment stage of development. Table II lists the substantive regulatory changes in transportation safeguards.⁵⁰ While there have been no significant changes in the transport safeguards since 1974, Tables III and IV present a group of additional protection requirements being offered for public comment.⁵¹ If these safeguards are eventually implemented, they would upgrade the overall transportation safeguard program considerably. The proposed road shipment protection requirements, for example, are particularly impressive. The requirement for a special vehicle with a separate escort vehicle carrying two guards would be desirable from two viewpoints. First, it would seriously complicate a non-employee attempt to hijack the vehicle. Secondly, it would go a long way to frustrate an attempt at hijacking by the special vehicle driver himself.

E. FEDERAL RESPONSE PLANS

Having taken up a discussion of the methods employed to safeguard nuclear material, it will be important to undertake

⁴⁹ *ibid.*, section 73.35.

⁵⁰ *Op. Cit.*, Larson.

⁵¹ *ibid.*

ASSESSMENT OF TRANSPORTATION SAFEGUARDS IMPROVEMENTS - 1974

IMPROVED PROTECTION THROUGH:

- Road, Railroad Shipments Escorted by Armed Guards
- Guards Trained, Qualified
- Preplanned Routes
- Locked Containers or Locked Compartments
- Transfers of Road Shipments Eliminated
- Other Transfers Minimized, Monitored by Guards
- Radio Telephone Communications for Road, Railroad Shipments
- Scheduled Call-in's to Control Point
- Automatic Response if Call-in's are not Received

Table II

PROPOSED ADDITIONAL TRANSPORT PROTECTION REQUIREMENTS: PUBLIC COMMENT STAGE

● Road Shipments by

- Special Vehicle with Separate Escort Vehicle Carrying Two Guards

or

- Armored Truck with Escort Vehicles, Each Carrying Two Guards
 - One Escort Vehicle if Continuous Radio Capability
 - Two Escort Vehicles Otherwise ..

Table III

PROPOSED ADDITIONAL TRANSPORT PROTECTION REQUIREMENTS: PUBLIC COMMENT STAGE (Continued)

- Air Shipment
 - U. S. Aircraft Only
 - Shipment Accompanied by Two Guards
 - Export Shipments Also Accompanied by Two Guards
- Rail Shipments Accompanied by 5 Guards
- Sea Shipments on U. S. Ships Only and Accompanied by Two Guards
- Transfers Monitored by Two Guards

Table IV

a discussion of what response can be expected from governmental agencies should a threat or hoax surface. A few years ago there were no response plans, no coordination or dialogue between agencies, no reaction mechanisms at all. In September of 1972, however, President Nixon established a Cabinet Committee to Combat Terrorism, the function of which is to "take the lead in establishing procedures to ensure that our government can take appropriate action in response to acts of terrorism swiftly and effectively."⁵² The working group, which carries out the daily business of the Committee, meets as a group every two weeks to discuss incidents and the operations of their departments. The group includes representatives from ERDA, NRC, FBI, NSA, NSC, CIA, DOD, the Department of State, Justice, Treasury, Transportation and other appropriate agencies. The working group formed the lines of communication necessary for coordinated responses to acts of terrorism. However, by Executive Order 11050, action was taken to create a government-wide response plan for nuclear emergencies. Under the authorship of the Federal Preparedness Agency (FPA), this document (the Federal Response Plan for Peacetime Nuclear Emergencies--FRPPNE) is designed to provide planning guidance for the preparation of federal, state and local operational response plans to peacetime nuclear emergencies (PNE's). Additionally, it is designed to facilitate a complete and coordinated federal planning effort that would

⁵² Nixon, R. M., Cabinet Committee to Combat Terrorism, The President's Memorandum to the Secretary of State on the Establishment of the Committee, 25 September 1972.

meet all PNE contingencies. Under this plan, the NRC is now responsible for developing operational plans for the federal response to nuclear incidents which, without preventative action, could result in the detonation of a weapon or widespread contamination. Although the response plan itself has not been promulgated by the NRC, Commission officials feel that a coordinated response is presently within the capability of ERDA and the NRC.

THREAT EVALUATION

The purpose of this section is not to determine the vulnerability of nuclear material or to question the adequacy of existing safeguards, but rather, it is to isolate and discuss those groups and individuals who not only appear to have sufficient resources to steal fissionable material but appear to be suitably motivated, as well. It is only by deriving the potential threat that any assessment can be made regarding the qualitative probability that a theft of special nuclear material can or will occur. First, it will be important to define operationally what is meant by the term "threat." Threat is defined as the capability of an individual or group to illicitly seize and maintain control of a significant quantity of fissionable material.

A. CAPABILITY

A precise definition of "capability" in quantified terms is well beyond the scope of this study; however, by using two significant variables it should be possible to develop a strong appreciation for different levels of capability which can be brought to bear by one group or individual as compared with others. The two most important variables appear to be resources and motivation.

1. Resources

The resource variable is the broadest of the two categories used to assess an individual or group's capability to

steal fissionable material successfully. The resources can include such things as material assets, access to SNM, access to intelligence-related information, education, training and skills. A few selected examples of specific resources that could (but not always do) improve an individual or group's capability are listed below:

- Material assets
 - Money
 - Automatic weapons
 - High explosives
 - Machine shop
 - Forged documents
- Access to SNM
 - Manager of a fuel fabrication plant
 - Vital area employee
 - Truck driver for SNM shipment
 - Air crewman for SNM air cargo shipment
- Access to intelligence information
 - Facility manager
 - Guard
 - Watchman
 - Almost any facility employee
- Education
 - Degree in Nuclear Physics
 - Degree in Engineering
 - Degree in Metallurgy
- Training & skills
 - Machinist
 - Military intelligence
 - Navy SEAL, Special Forces or Marine reconnaissance experience
 - Civilian or military training in nuclear weapons.

It should be relatively obvious that the extent to which the above resources would improve a group's overall theft capability depends precisely on the type of theft, the plan, the group membership, and so on.

2. Motivation

Perhaps the most important aspect of any threat evaluation is motivation; in this case, what impulse would

incite anyone to try to steal fissionable material? To examine this question, it is useful to consult figure 7. The motivational spectrum presented certainly does not address all of the fundamental forms of motivation, i.e., survival, desire for the basic material needs, etc.; however, it does come to grips with motivation on a very basic level, and it seems to cover the motivational spectrum functional in conventional threat analysis. The reader will notice that the spectrum seems to extend from the tangible achievements associated with financial gain to some very intangible achievements associated with personal or group frustration. Examples of criminal activity which are instigated by a desire for financial gain or frustration can range from a wife who kills her husband to collect on his insurance policy to Sirhan Sirhan's assassination of Robert Kennedy "out of love for Palestine."⁵³ Both people have committed criminal acts against society. The first crime is committed for a tangible reward--money; but it is difficult to determine what tangible achievement could be expected from the assassination of Senator Kennedy.

The spectrum is in some sense continuous, i.e., there are those motivated by a combination of impulses, for example, political change and financial wealth. Consequently, they could be plotted somewhere along the line between economic and political motivation. Some examples of the type of motivation and possible corresponding groups or individuals are given:

⁵³ Bell, J. B., Transnational Terror, p. 11, American Enterprise Institute for Public Policy Research, 1975.

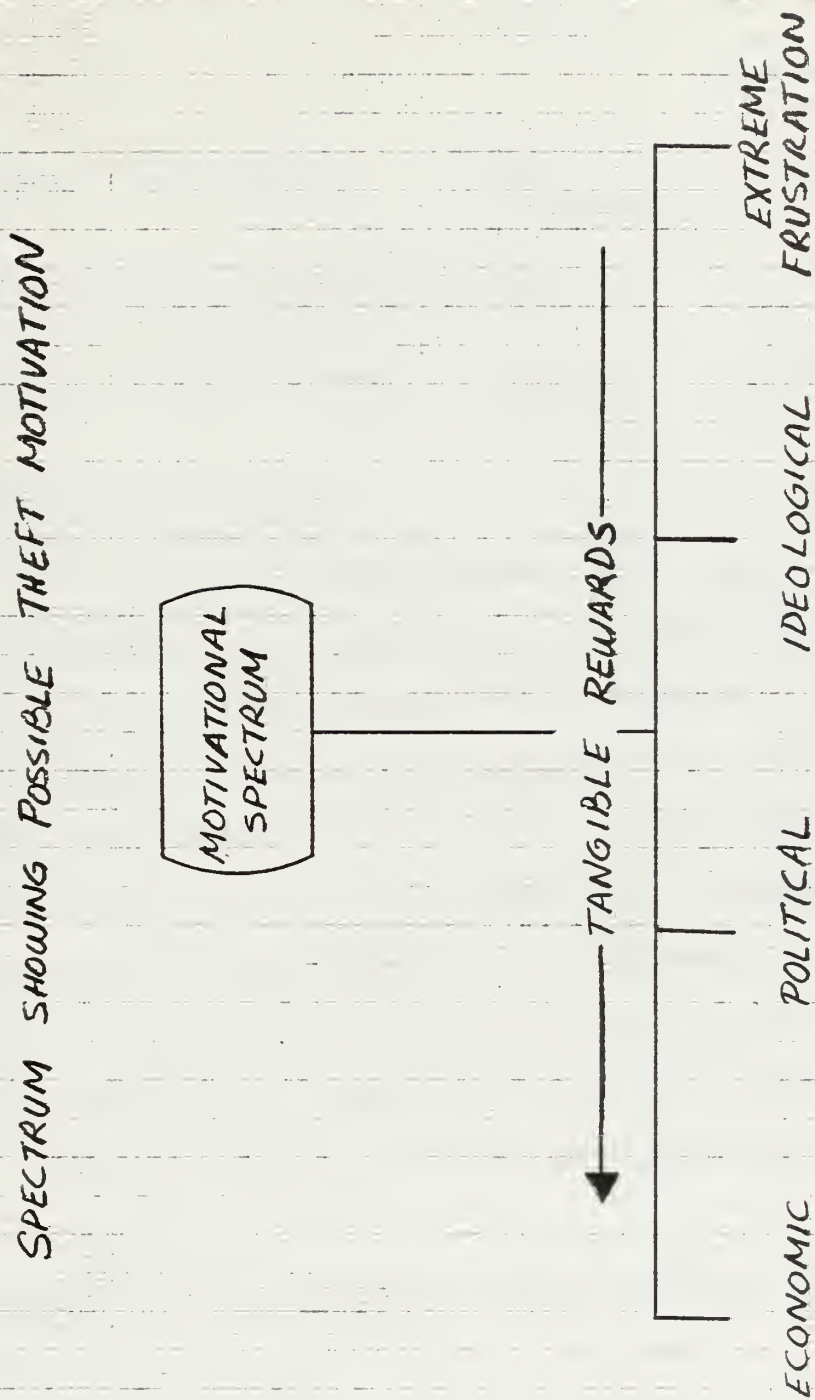


Figure 7

<u>Class</u>	<u>Group/Individual</u>	<u>Incident</u>	<u>Motivation</u>
Terrorist	PLO	Bombing at La Guardia	Political (recognize Palestinian state)
Criminal	Mafia	Drug trafficking	Economic
Subversive	Soviet Communist	Theft of war plan	Ideological
Psychotic	Arthur Bremer	Shot Gov. Wallace	Extreme frustration

B. MORPHOLOGICAL APPROACH

In order to get some comparative "feel" for the candidates who appear to have the best capacity to steal fissionable material, it was decided to use a morphological approach to problem solving similar to that professed by Fritz Zwicky.⁵⁴ This method was chosen early in the research phase when the author was confronted with the considerable problem of comparing resources. For example, if a five-man terrorist group attacks a storage facility, what increase in group capability would be yielded by the addition of one well-armed man? What is the increased capability if the additional man happens to be an employee?

The morphological approach seemed to offer a method of systematically examining all possible levels of capability as a function of group size and classification (see figure 8). Because the system can theoretically examine all possibilities, it is an extremely powerful technique. Of course, it is also

⁵⁴ Zwicky, F. and Wilson, A. G., ed., New Methods of Thought and Procedure, p. 273-313, Springer-Verlag, 1967.

POTENTIAL ATTACKERS		RESOURCES																				CONSTRAINTS					EVAL		
		STORAGE					TRANSPORT					AIR TRANS					DIVERSION												
NO. PERS.	CLASSIFICATION	FINANCES	ADVANCED WEAPONS	KNOW SECURITY	KNOW PLANT	MILITARY EXPERIENCE	FINANCES	TRUCK AND EQUIPMENT	KNOW COMMO PLAN	KNOW ROUTE	MILITARY EXPERIENCE	FINANCES	KNOW FLIGHT PLAN	AIRCRAFT EXPERIENCE	NAVIGATION ABILITY	PILOT EXPERIENCE	KNOW ACCOUNTANCY	ACCESS TO ACCT'ANCY	KNOW PLANT PROCESSES	KNOW SURVEILLANCE	OPPORTUNITY	VIOLENT POTENTIAL	TECHNICAL ABILITY	STORAGE	TRANSPORT	AIR TRANSPORT	DIVERSION		
1	EMPLOYEE, DRIVER	X	X	X	X			X	X	X								X		X		X			2	3	0	0	1
2	EMPLOYEE, PLANT			X	X				X	X					X			X		X		X			2	2	0	4	2
5-7	ORGANIZED CRIME	X	X			X	X	X	X				X	X			X	X				X	X		3	5	4	0	3
5-7	TERRORIST, POL.	X	X			X	X	X														X	X		3	3	1	0	2
14-16	TERRORIST, POL.	X	X			X	X	X					X		X							X	X		3	3	2	0	2

MORPHOLOGICAL APPROACH TO THREAT EVALUATION

Figure 8

this "power" which makes it an extremely tedious operation. Consequently, the size of a group was allowed to range over several numbers to simplify the operation. Instead of increasing the size of the group by one each time, reasonable group sizes were formed, i.e., one individual acting alone, two to four individuals, five to seven individuals, etc.⁵⁵

The morphological approach did not indicate much change with regard to increased capacity for success resulting from an increase in the size of a particular group. If a group's size was increased from an average of nine to an average of eighteen members, no change in capability could be discerned. It was obvious that the group's resources increased considerably but so did the chances that the operation would be compromised. The result was that common sense had to be applied liberally during the grading and evaluation stages of comparison.

Analysis which was based on the type (classification) of thief resulted in clear and useful correlations. Of particular note was the increase in capability possible if, for example, organized crime and employees were to participate together in an operation. Categories were formed according to the three principle types of theft discussed previously, i.e., diversion, theft of nuclear material in storage and hijacking. Hijacking was separated into its most vulnerable carrier methods, truck

⁵⁵ This three-man grouping method was not used steadfastly. For example, the breakpoint in the size of the employee classification seemed to be between two and three. Two employees entering into collusion seemed credible; three employees in collusion did not.

and air. Resources were then listed which could be of importance to the individual or group carrying out the theft. Although there are other resources which would be helpful in the conduct of a nuclear theft, it is felt that those resources itemized would make a significant contribution to a successful theft or diversion. These theft resources could certainly be expanded to include others; however, too many resource categories would demand specific operation plans in order to analyze threat. Following the list of useful resources is a list of constraints which if not satisfactorily counterbalanced by the resources, tend to detract from the credibility of an operation.

The particular constraints used were "potential for violence," "opportunity," and "technological ability." Although the three constraints used were judgementally applied, they were very useful in narrowing the field of serious candidates. The concept of "potential for violence" is a phenomena referring to the likelihood that one group or individual would be more inclined to use a significant level of force in order to carry out a theft than another group or individual.

Two nuclear power industry scientists might conclude, for example, that the proliferation of fissionable material caused by the expansion of the nuclear power industry would destroy society as we know it. Their solution is to steal "special nuclear material" to dramatize the danger the world faces. The question arises, however: would these scientists be willing to use "deadly force" in the commission of the crime?

Would they be willing to eliminate one or two uncooperative guards? Would a group of terrorists, in comparison, be willing to use "deadly force" in the commission of a similar crime? It would appear that the scientists would be more constrained than terrorists, and that constraint tends to detract from the credibility that a violent type of theft would be carried out by the scientific group. On the other hand, the scientific group would be much better qualified to divert SNM successfully.

Another constraint--opportunity--is a fairly straight forward concept referring to the degree of access the perpetrator(s) has to SNM. The third constraint used deals with the perpetrator's(s') technical ability to carry out those procedures required for the construction of a weapon.⁵⁶ Although not specifically subdivided, this category includes educational background as well as material assets and skills unrelated to those required for the theft itself. Some examples are an advanced degree in nuclear physics or engineering, a laboratory, a machine shop, laboratory and machinist skills.

By employing the morphological approach in this manner, the author was able to review and discard a tremendous number of theft candidates without resort to mathematical operations. Some tacit assumptions were made which profoundly effect the

⁵⁶ The ability to perpetrate a hoax or sell the material on the black market, etc., is more or less given to all candidates, although these possibilities are discussed more critically further along in the study.

apparent capabilities of the groups. In the second example presented in figure 8, the two plant employees are given credit for having knowledge and access to accountancy procedures, a knowledge of plant processes and a knowledge of the surveillance measures used by the plant. Obviously, not all plant employees have access to this type of information. The assumption is that the employees occupy key positions. Similarly, the third example assumes that the five to seven criminals have the backing of a large organization and can draw upon its resources. It is also assumed that such an organization would be in a position to enlist the assistance of an appropriate employee of the trucking industry. Justification for this assumption is addressed under the motivation segment.

The outcome of the morphological-type analysis has been to narrow the field of candidates down to a few of the more capable groups. The flaw with this type of selection process is that the selection of groups is almost completely resource-oriented. Because an organization has the resources necessary to conduct a successful theft does not mean that it will be motivated to try. Motivation must be discussed at length with the individual candidates for theft systematically analyzed.

C. GROUPS WITH SUFFICIENT CAPABILITY TO CONDUCT A NUCLEAR THEFT

1. Employee Theft

A nuclear theft by one person acting alone does not seem especially credible for any of the types of theft presented. Although it appears that certain employees could come

quite close to carrying out the theft single-handedly, the assistance of at least one other person would upgrade the credibility of the theft considerably. A reprocessing plant manager, for example, has tremendous potential in the area of diversion. He has access to accountancy records and could very likely confuse accurate accounting measures beyond rectification. He usually has direct access to SNM and can probably bypass at least a few plant regulations by virtue of his position. If the plant properly enforces a "two-man rule," however, the manager would have to enter into collusion with another employee. Consequently a most credible diversion scenario can be built upon collusion between two reprocessing plant employees, one of which is in a managerial position with considerable authority and access to accountancy figures.⁵⁷ Both would need access to SNM. There are problems associated with the theft of nuclear material by two employees which are greater than those encountered by other groups. Since there are only two persons, they must possess all of the requisite knowledge and skills needed to perform the theft and construct the weapon. The foregoing conclusion should be handled with care because the two thieves could sell the material to a black market of some kind or ransom the nuclear material, but either one of these options might well take more imagination

⁵⁷ Op. Cit., Willrich, M., p. 13. As mentioned previously, it is conceivable that the diversion has taken place to some extent. Witness the following--"There have been a few bad experiences with management in the United States. Although there has been no evidence of diversion, there have been a few cases where amounts of material have disappeared that were far above reasonable errors that could result from technical difficulties of operation or analysis or accounting."

than the theft itself. In the case of the black market, they would require a "fence" and would have to use some imaginative scheme to protect themselves during the payoff period. In the case of ransom, they would be faced with the problem of collecting the money without being detected by law enforcement agencies, a risky proposition at best.

For this type of theft, financial gain appears to be the most likely motivational force although other possible motivational factors range from a desire for wealth to mental instability. It is not comforting to know that embezzlement, a concept very similar to diversion, is undertaken by financial institution employees every year. If there is any doubt that there are employees in the nuclear fuel industry properly motivated to steal fissionable material, the following quote should dispel that doubt: "To date, there have been a few reported losses of strategic material, although only one is said publicly to have involved an attempted theft.... In Bradwell, England, two reactor plant workers dropped 20 fuel rods over the plant fence and left them, apparently to be picked up."⁵⁸ Fortunately, the theft was intercepted.

2. Theft by Terrorists

The threat that terrorists pose to nuclear material, or at least the perceived threat, is to a large extent responsible for the new clamor for the tightening of nuclear safeguards. The phenomenal increase in anti-social behavior

⁵⁸ Shapley, D., "Plutonium: Reactor Proliferation Threatens a Nuclear Blackmarket," Science, p. 68, 9 April 1971.

is demonstrated by the air piracy example. Between the years of 1948 and 1958 there was an average of 2.1 hijackings per year. By 1963, the average had risen to 3.3 per year. Despite the convening of international conferences to curb air piracy, the world average had increased to 7.2 hijackings per year by 1968. Two years later this figure zoomed to an unprecedented level--50.5 successful air piracy operations per year.⁵⁹ Perhaps even more distressing than the hijackings themselves were the associated activities: indiscriminate murder, outrageous demands, and the slow reaction of the governments around the world to cope with the phenomenon. To a large extent, the terrorists' capability to inflict damage upon society stems from the destructive power of new sophisticated, man-portable weapons, the vulnerability of complex technologies and social sub-systems, and the unpredictability of terrorist targeting procedures. An example of the problems associated with checking terrorist activity is demonstrated in the following quote from "The Ecology of Terrorism":

"...it is extremely difficult to predict and prevent attacks such as the 'Kamikaze' one launched at Lydda airport, primarily because the rationale of the predators was totally alien to the environment assaulted. Kozo Okamoto stated to the military court in Jerusalem which tried and convicted him for the Lydda butchery that he and his companions acted in order to promote 'the World Revolution'. He added that both the executioners and their victims, 'united in death', would be reincarnated as stars, and that their joint illumination would shed 'eternal peace on earth'. A political tragedy incorporating mystic symbolism with compulsive ideologized violence, executed according to an ancient, Bushido Code, in a modern airport which is both geographically and culturally remote from Japan is--to say the least--difficult to foresee."⁶⁰

⁵⁹ Segre, D. V. and Adler, J. H., "The Ecology of Terrorism," V. XV, p. 178-179, July/August 1973.

⁶⁰ *ibid.*, p. 183.

Partially because of instances similar to that quoted above, terrorists (a miniscule proportion of the population) have become very effective in making a given option appear more desirable to major portions of society or at least forcing society to consider different options. This has been achieved chiefly through a technique referred to as "random terror." Random terror is incomprehensible to most members of society primarily because the selection of those to be killed, maimed or otherwise incapacitated is left to relatively chance factors, e.g., a bomb tossed into the midst of a crowd at a sporting event. Society, unable to rationalize this type of action, becomes more fearful and the terrorists hope more amenable to the demands of a numerically insignificant portion of society. Should terrorists become equipped with nuclear weapons, the impact of successful terrorist acts on the public would be incalculable. The consequences could certainly jeopardize society as we know it.

Terrorists unquestionably pose a credible threat to the nuclear power industry. The reasons for this are numerous. Since terrorists are usually ideologically or politically motivated, they would most likely ascribe their efforts to the quest for a "greater good." As such, their determination is likely to be more substantial and the level of acceptable risks greater than those seeking monetary gain. Because terrorists would primarily seek political change, their ransom could be in the form of governmental concessions. In this manner, the group would never be required to retrieve money

which could lead to their eventual capture. Furthermore, terrorists have in the past displayed the means of acquiring substantial sums of money, automatic weapons, and explosives. In light of events similar to those which occurred at the 1972 Olympic Games, it would appear that terrorist groups are capable of executing bold and surprising action quite a bit more problematic than the hijacking of a nuclear material vehicle.

At least from a resources and violent potential point of view, terrorist organizations seem to be well qualified nuclear theft candidates; however, there is considerable disagreement regarding their motivation to commit nuclear theft. It is argued that with the tremendous advances in weapons designed for the individual, due mainly to miniaturization, "a new range of small, portable, easy to operate, highly accurate, and highly destructive weapons are coming into existence... [These types of weapons] can be employed as effectively against civil aircraft, super-tankers, motorcades, and speaker's podiums as against military targets."⁶¹ Because these new weapons give terrorists such a tremendous ability to inflict harm on society, there is no need for them to undertake the complex and risky operation of stealing fissionable material in order to build a nuclear weapon. In fact, detonation of a nuclear weapon by terrorists, killing thousands, could prove dysfunctional to their cause.

⁶¹ Fearey, R. A., Terroristic Activity, International Terrorism, hearings before the Administration of the Internal Security Act and other Internal Security Laws of the Committee of the Judiciary, U.S. Senate, 14 May 1975.

"After all, had they wanted to, terrorists could already have done a number of things which could produce widespread casualties. Apart from the technical difficulties involved, which are less than those involved in putting together an atomic bomb, why haven't terrorists threatened to contaminate a city's water supply? Certainly there must be some constraints, other than technical ones, against killing thousands. There are, of course: to begin with, moral ones. Despite the popular view of them, terrorists, for the most part, are not wanton killers. There are also practical arguments against mass murder. Killing a lot of people is seldom an objective of terrorism. High body counts do not necessarily further their objectives, and can provoke a damaging backlash."⁵²

Although the Jenkins argument makes a certain amount of sense, there are some very solid reasons for thinking that some terrorist groups would be overjoyed at the prospects of acquiring fissionable material and/or a nuclear weapon. The basic objectives of terrorism seem to be to gain publicity, to instill fear in the public, and to drive the government into a policy of repression which will eventually undermine its middle-of-the-road support. The theft of fissionable material would almost certainly contribute to the achievement of these goals. The mere mention of the words "radioactive," "nuclear" or "atomic" would create a climate of fear unprecedented in this country. The "media" would insure unprecedented publicity, and the U.S. Government would be forced to react in an unprecedented manner--a manner deemed offensive to many, perhaps unconstitutional to some, but necessary. Furthermore, there are terrorist organizations probably willing to use a nuclear weapon. Small terrorist groups which have few

⁵² Jenkins, B. M., High Technology Terrorism and Surrogate War: The Impact of New Technology on Low-Level Violence, p. 11, Rand Corporation, January 1975.

inhibitions and have no constituency to alienate would be particularly dangerous. A member of the Manson Family was willing to try to assassinate a President. This miniscule group of social failures has threatened death to those who pollute the earth. Would such radicals be willing to detonate a nuclear weapon at a General Electric plant to dramatize their point? Fissionable material is one of the very few items in the world that would offer immediate publicity, create fear in the public, cause untold problems for the government and at the same time be a saleable commodity after all demands had been met. Lastly, there are terrorists which have as their objectives the demise of all nuclear power programs. Would a nuclear theft suit their objectives?

3. Theft by Criminal Organizations

From a resource point of view, organized crime clearly poses a threat as credible as that for political terrorist organizations. Criminal organizations have the financial backing required to support extensive training exercises; the political influence is there if required; forged documents are easily obtained; sterile (untraceable) weapons are available; and procedures for moving personnel and material across borders clandestinely have been long established. In the case of a truck hijacking, trucking employees may be under the influence of organized crime. Evidence of criminal influence in the trucking industry was revealed by Wright, Long and Company after the completion of an extensive study contracted by the AEC. The study determined that "on a list of 735 so-called

Mafia members, 12 are or were the owners of trucking firms, two are truck drivers and at least nine were union officials."⁶³ While talking to the Atomic Energy Commission at a Los Alamos safeguards conference, truckers agreed that organized crime could quite easily obtain nuclear material if they so desired. "Anything that organized crime wants to lay its hands on, while it's in the transportation cycle, it's going to get."⁶⁴

The overriding motivational force for criminals would seem to be monetary gain. In this regard, a well organized group would probably be more willing to sell the material through a black market operation than to risk capture by constructing a weapon itself and demanding a ransom. However, Willrich and Taylor point out that "organized crime" might be willing to construct a weapon and hold it as hostage, thus placing itself beyond the reach of the law. This type of hostage alternative has very little face validity, however, in that large prospering organizations would probably view the risks involved as outweighing the gains. Should the deterrent value of the constructed weapon for some reason fail to deter law enforcement agencies, the organization would be forced to either use the weapon or back down. In either case, the organization would probably be destroyed and the whole operation would prove self-defeating.⁶⁵

⁶³ United States Atomic Energy Commission, Washington Conference on Transportation Safeguards, 2 October 1969. See also Los Alamos Safeguards Conference proceedings, WASH 1147, p. 21-38.

⁶⁴ Op. Cit., Shapley, p. 19.

⁶⁵ Op. Cit., Taylor, p. 112.

It seems much more likely that organized crime would become involved in the creation of a fissionable material black market for sale abroad. Although the going rate for plutonium is \$10,000 per kilogram, this price would undoubtedly skyrocket as the demand developed and the material realistically became available, making it a fantastically lucrative affair. Various authors have argued, however, that organized crime is too conservative to become involved with the theft of material that can be illicitly used to construct atomic bombs. Since decision makers in this type of criminal group are thought to be affluent, their stake in society is likely to be quite large. Nuclear weapons in the hands of private individuals could cause revolutionary changes in law, law enforcement, and public opinion that could destroy ordinary criminal organizations as a byproduct of nuclear safety.

On the other hand, organized crime may be forced into the nuclear theft business in order to survive. It is felt that some "families" did not want to get into the drug business on moral grounds. But because of the vast sums of money to be made, it was decided that the competition would use increased revenues gained from the sale of drugs to force the non-drug families out of business.

In addition to "organized crime," it can be argued that a nuclear theft could be initiated by a group of criminals less interested in the societal consequences of their actions. This type of group would probably be organized for the sole purpose of committing the nuclear theft and would then disband.

Many major thefts have been conducted in this manner, some requiring as much as two years in the planning and rehearsal stages. In addition to common equipment and weapons, law enforcement officials are beginning to see the use of sophisticated electronic equipment utilized to neutralize alarm systems, radio monitoring devices, silenced weapons, gas grenades and the like. The fact is that many major crimes involve an incredible amount of time, planning, training and equipment.

CONCLUSION

This study was undertaken with a few biases in mind. Initial research included the reading of many sensationalist articles, critical reports by the Government Accounting Office, the Rosenbaum Report, and the Taylor book. The author's personal feelings after the initial research were that the public should take a closer look at the whole nuclear power program, that regulatory safeguards were generally inadequate, that governmental bodies administering the safeguards were not fully effective, that the construction of a weapon would be relatively easy, and that some type of federal security agency was required to protect special nuclear material. It is not surprising that the most widely publicized articles drew pessimistic conclusions proving perhaps that sensationalism sells magazines and books. Hopefully, the following conclusions will merit a little more consideration than those initially formed.

A. GENERAL CONCLUSIONS

It is becoming apparent to many in this country that the need for additional substantive nuclear safeguards is clear and present. As discussed earlier in this essay, thousands of pounds of fissionable material are in some stage of production or storage in the United States alone. This material is required as fuel for over 60 nuclear power plants presently operating. By 1980 it is expected that there will be in excess

of 150 nuclear power plants in operation. These plants will require at least three times the fissionable material presently being stored and transported. Clearly, the potential for nuclear theft will not abate in the foreseeable future due to a lack of material.

It should be just as obvious that there are periods during the nuclear fuel cycle when nuclear materials present a lucrative target for persons sufficiently motivated to commit a nuclear theft. The unfortunate fact is that we appear to have several groups who meet the motivational criteria. An alarming but realistic conclusion is that not only do criminal groups and terrorists have the motivation necessary, but they have repeatedly proven their capabilities to execute more adventurous enterprises successfully.

B. SPECIFIC CONCLUSIONS

1. The Availability of Weapons-Grade Material

The availability of weapons-grade nuclear material is presently low, but the situation will change drastically with the advent of plutonium recycle. Although the decision as to whether to allow plutonium recycle or not is still under review by the Nuclear Regulatory Commission (the decision will be made in about eight months), unofficial conversations with Commission officials indicate that plutonium recycle will be allowed to commence barring an unforeseen public outcry. The reasons behind the pro-industry stance by the Commission stem from a genuine feeling that safeguards can meet "private"

threat projections (considered to be five well-armed men now, and ten well-armed men in the near future).⁶⁶

The introduction of the liquid-metal fast breeder reactor will increase the availability of weapons-grade nuclear material on the same order as plutonium recycle. If both of these programs are realized, the influx in the availability of SNM will surely be phenomenal. Industry and government acting in concert (which they rarely do) would be hard-pressed to adequately protect the quantities of SNM subject to shipping, storage, processing, etc. Even though there are some palatable solutions to the issue of safeguards, their eventual acceptance is highly questionable.⁶⁷

2. Weapon Construction

The construction of a nuclear weapon would appear to be within the capability of numerous groups and organizations with either the membership talent or the finances to procure the talent. However, it would be a mistake to conclude that a weapon can be constructed haphazardly or with little imagination or technical ability. On the other hand, the argument is almost superfluous because anyone who has successfully stolen a "bomb-size" quantity of SNM must be assumed to have

⁶⁶ This unofficial assessment is still considerably less than the Rosenbaum Report's threat projection.

⁶⁷ Two of the alternatives are: The introduction of a nuclear park concept which would localize all fuel cycle processes to the reactor site, thus eliminating shipment of SNM and allowing industry to concentrate its security expenditures on the protection of the park; the second alternative is to reduce the growth of nuclear power and turn to the development of other sources of energy.

the capability to construct a weapon. The capability must be assumed especially in the ransom demand situation; it matters little whether or not ERDA and the NRC are convinced that a group of successful thieves can build a bomb, the point becomes, is the risk acceptable to the government--to the public? It seems that worst case analysis would have to be applied.

3. Safeguards Adequacy

Table I is representative of the substantial improvement made in the area of nuclear safeguards over the past few years. To be sure, the Commission and its predecessor, the AEC, have been effective in lowering the risk to the public associated with the theft of nuclear material. If the safeguards presently under consideration by the Commission are implemented (see tables III and IV), the risk will be reduced even further. However, until such time as these and other safeguards are implemented, several areas will remain in need of attention. Those areas in need of particular attention are the diversion or embezzlement of SNM by employees, employee or non-employee-related hijacking of an air cargo shipment, and the employee-related hijacking of an SNM shipment made by truck. It is the opinion of this study that these forms of theft remain highly credible and exceed a level of risk thought to be generally acceptable.

4. Who Poses a Significant Threat

In contrast to several highly regarded studies of nuclear theft, it is concluded that organized crime in concert with nuclear industry or carrier employees pose the greatest

threat to nuclear materials in non-hostage scenarios. Given employee collusion, organized crime would appear to have an abundance of resources enabling it to carry out any of the most credible forms of theft cited above. Furthermore, it is felt that demand for SNM (i.e., from third-world nations) will create sufficient economic incentives to push organized crime into a nuclear black market arrangement.

Terrorists seem to pose the greatest threat to SNM in hostage-type situations; that is, in situations whereby material is stolen overtly and held as hostage so that no arrests could be made by law enforcement agencies without risking the dispersal of radioactive material. Subsequently, demands could be made and so on. Although terrorists have in the past displayed the means of acquiring substantial sums of money and talent, most organizations probably do not have these resources and must be satisfied with automatic weapons, explosives and the execution of bold and surprising action. Taking plutonium hostage would appear to serve a terrorist group well with regard to publicity, bargaining power, and the creation of a fearful situation.

The actual construction of a bomb by most terrorists does not seem to be especially credible because of their relative paucity of resources and talent. Also, as Jenkins has pointed out, it may not be altogether in the interests of a terrorist group to explode a nuclear weapon which actually kills thousands. The line of reasoning used by Jenkins is not extremely compelling, and yet it has influenced the thinking

of key government people from the State Department, the Justice Department and the NRC. In fact, a substantial percentage of the people interviewed in key Washington agencies seemed to have adopted the attitude that safeguards were being improved even though it was not really necessary. In light of some of the unpredictable operations terrorists have become involved with recently, it may not be wise to rule terrorists out of the bomb-building business.

APPENDIX A

THE ENERGY REORGANIZATION ACT OF 1974



Public Law 93-438
93rd Congress, H. R. 11510
October 11, 1974

An Act

To reorganize and consolidate certain functions of the Federal Government in a new Energy Research and Development Administration and in a new Nuclear Regulatory Commission in order to promote more efficient management of such functions.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Energy Reorganization Act of 1974.

SHORT TITLE

SECTION 1. This Act may be cited as the "Energy Reorganization Act of 1974".

42 USC 5801 note.

DECLARATION OF PURPOSE

SEC. 2. (a) The Congress hereby declares that the general welfare and the common defense and security require effective action to develop, and increase the efficiency and reliability of use of, all energy sources to meet the needs of present and future generations, to increase the productivity of the national economy and strengthen its position in regard to international trade, to make the Nation self-sufficient in energy, to advance the goals of restoring, protecting, and enhancing environmental quality, and to assure public health and safety.

42 USC 5801.

(b) The Congress finds that, to best achieve these objectives, improve Government operations, and assure the coordinated and effective development of all energy sources, it is necessary to establish an Energy Research and Development Administration to bring together and direct Federal activities relating to research and development on the various sources of energy, to increase the efficiency and reliability in the use of energy, and to carry out the performance of other functions, including but not limited to the Atomic Energy Commission's military and production activities and its general basic research activities. In establishing an Energy Research and Development Administration to achieve these objectives, the Congress intends that all possible sources of energy be developed consistent with warranted priorities.

Energy Research and Development Administration, establishment.

(c) The Congress finds that it is in the public interest that the licensing and related regulatory functions of the Atomic Energy Commission be separated from the performance of the other functions of the Commission, and that this separation be effected in an orderly manner, pursuant to this Act, assuring adequacy of technical and other resources necessary for the performance of each.

88 STAT. 1233
88 STAT. 1234

Separation of AEC licensing and regulatory functions.

(d) The Congress declares that it is in the public interest and the policy of Congress that small business concerns be given a reasonable opportunity to participate, insofar as is possible, fairly and equitably in grants, contracts, purchases, and other Federal activities relating to research, development, and demonstration of sources of energy efficiency, and utilization and conservation of energy. In carrying out this policy, to the extent practicable, the Administrator shall consult with the Administrator of the Small Business Administration.

Small business participation.

(e) Determination of priorities which are warranted should be based on such considerations as power-related values of an energy source, preservation of material resources, reduction of pollutants, export market potential (including reduction of imports), among others. On such a basis, energy sources warranting priority might include, but not be limited to, the various methods of utilizing solar energy.

Priorities.

TITLE I—ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

ESTABLISHMENT

42 USC 5811.

SEC. 101. There is hereby established an independent executive agency to be known as the Energy Research and Development Administration (hereinafter in this Act referred to as the "Administration").

OFFICERS

Administrator.
42 USC 5812.

SEC. 102. (a) There shall be at the head of the Administration an Administrator of Energy Research and Development (hereinafter in this Act referred to as the "Administrator"), who shall be appointed from civilian life by the President by and with the advice and consent of the Senate. A person may not be appointed as Administrator within two years after release from active duty as a commissioned officer of a regular component of an Armed Force. The Administration shall be administered under the supervision and direction of the Administrator, who shall be responsible for the efficient and coordinated management of the Administration.

Deputy
Administrator.
88 STAT. 1234
88 STAT. 1235

(b) There shall be in the Administration a Deputy Administrator, who shall be appointed by the President, by and with the advice and consent of the Senate.

(c) The President shall appoint the Administrator and Deputy Administrator from among individuals who, by reason of their general background and experience are specially qualified to manage a full range of energy research and development programs.

Assistant
Administrators.

(d) There shall be in the Administration six Assistant Administrators, one of whom shall be responsible for fossil energy, another for nuclear energy, another for environment and safety, another for conservation, another for solar, geothermal, and advanced energy systems, and another for national security. The Assistant Administrators shall be appointed by the President, by and with the advice and consent of the Senate. The President shall appoint each Assistant Administrator from among individuals who, by reason of general background and experience, are specially qualified to manage the energy technology area assigned to such Assistant Administrator.

General Counsel.

(e) There shall be in the Administration a General Counsel who shall be appointed by the Administrator and who shall serve at the pleasure of and be removable by the Administrator.

Additional
officers.

(f) There shall be in the Administration not more than eight additional officers appointed by the Administrator. The positions of such officers shall be considered career positions and be subject to subsection 161 d. of the Atomic Energy Act.

Director of
Military
Application.

(g) The Division of Military Application transferred to and established in the Administration by section 104(d) of this Act shall be under the direction of a Director of Military Application, who shall be appointed by the Administrator and who shall serve at the pleasure of and be removable by the Administrator and shall be an active commissioned officer of the Armed Forces serving in general or flag officer rank or grade. The functions, qualifications, and compensation of the Director of Military Application shall be the same as those provided under the Atomic Energy Act of 1954, as amended, for the Assistant General Manager for Military Application.

42 USC 2011
note.

(h) Officers appointed pursuant to this section shall perform such functions as the Administrator shall specify from time to time. The Administrator shall delegate to one such officer the special responsibility for international cooperation in all energy and related environmental research and development.

International
cooperation.

(i) The Deputy Administrator (or in the absence or disability of the Deputy Administrator, or in the event of a vacancy in the office of the Deputy Administrator, an Assistant Administrator, the General Counsel or such other official, determined according to such order as the Administrator shall prescribe) shall act for and perform the functions of the Administrator during any absence or disability of the Administrator or in the event of a vacancy in the office of the Administrator.

Order of
succession.

RESPONSIBILITIES OF THE ADMINISTRATOR

SEC. 103. The responsibilities of the Administrator shall include, but not be limited to— 42 USC 5813.

(1) exercising central responsibility for policy planning, coordination, support, and management of research and development programs respecting all energy sources, including assessing the requirements for research and development in regard to various energy sources in relation to near-term and long-range needs, policy planning in regard to meeting those requirements, undertaking programs for the optimal development of the various forms of energy sources, managing such programs, and disseminating information resulting therefrom:

88 STAT.1235
88 STAT.1235

(2) encouraging and conducting research and development, including demonstration of commercial feasibility and practical applications of the extraction, conversion, storage, transmission, and utilization phases related to the development and use of energy from fossil, nuclear, solar, geothermal, and other energy sources;

(3) engaging in and supporting environmental, biomedical, physical, and safety research related to the development of energy sources and utilization technologies;

(4) taking into account the existence, progress, and results of other public and private research and development activities, including those activities of the Federal Energy Administration relating to the development of energy resources using currently available technology in promoting increased utilization of energy resources, relevant to the Administration's mission in formulating its own research and development programs;

(5) participating in and supporting cooperative research and development projects which may involve contributions by public or private persons or agencies, of financial or other resources to the performance of the work;

(6) developing, collecting, distributing, and making available for distribution, scientific and technical information concerning the manufacture or development of energy and its efficient extraction, conversion, transmission, and utilization;

(7) creating and encouraging the development of general information to the public on all energy conservation technologies and energy sources as they become available for general use, and the Administrator, in conjunction with the Administrator of the Federal Energy Administration shall, to the extent practicable, disseminate such information through the use of mass communications;

(8) encouraging and conducting research and development in energy conservation, which shall be directed toward the goals of reducing total energy consumption to the maximum extent practicable, and toward maximum possible improvement in the efficiency of energy use. Development of new and improved con-

servations measures shall be conducted with the goal of the most expeditious possible application of these measures;

(9) encouraging and participating in international cooperation in energy and related environmental research and development;

88 STAT. 1236
88 STAT. 1237

(10) helping to assure an adequate supply of manpower for the accomplishment of energy research and development programs, by sponsoring and assisting in education and training activities in institutions of higher education, vocational schools, and other institutions, and by assuring the collection, analysis, and dissemination of necessary manpower supply and demand data;

(11) encouraging and conducting research and development in clean and renewable energy sources.

ABOLITION AND TRANSFERS

Atomic Energy
Commission.
42 USC 5814.

SEC. 104. (a) The Atomic Energy Commission is hereby abolished. Sections 21 and 22 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2031 and 2032) are repealed.

(b) All other functions of the Commission, the Chairman and members of the Commission, and the officers and components of the Commission are hereby transferred or allowed to lapse pursuant to the provisions of this Act.

(c) There are hereby transferred to and vested in the Administrator all functions of the Atomic Energy Commission, the Chairman and members of the Commission, and the officers and components of the Commission, except as otherwise provided in this Act.

(d) The General Advisory Committee established pursuant to section 26 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2036), the Patent Compensation Board established pursuant to section 157 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2187), and the Divisions of Military Application and Naval Reactors established pursuant to section 25 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2035), are transferred to the Energy Research and Development Administration and the functions of the Commission with respect thereto, and with respect to relations with the Military Liaison Committee established by section 27 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2037), are transferred to the Administrator.

Interior
Department
functions.

(e) There are hereby transferred to and vested in the Administrator such functions of the Secretary of the Interior, the Department of the Interior, and officers and components of such department—

(1) as relate to or are utilized by the Office of Coal Research established pursuant to the Act of July 1, 1960 (74 Stat. 336; 30 U.S.C. 661-668);

(2) as relate to or are utilized in connection with fossil fuel energy research and development programs and related activities conducted by the Bureau of Mines "energy centers" and synthane plant to provide greater efficiency in the extraction, processing, and utilization of energy resources for the purpose of conserving those resources, developing alternative energy resources, such as oil and gas secondary and tertiary recovery, oil shale and synthetic fuels, improving methods of managing energy-related wastes and pollutants, and providing technical guidance needed to establish and administer national energy policies; and

(3) as relate to or are utilized for underground electric power transmission research.

Helium applica-
tions study.

The Administrator shall conduct a study of the potential energy applications of helium and, within six months from the date of the

enactment of this Act, report to the President and Congress his recommendations concerning the management of the Federal helium programs, as they relate to energy.

(f) There are hereby transferred to and vested in the Administrator such functions of the National Science Foundation as relate to or are utilized in connection with—

- (1) solar heating and cooling development; and
- (2) geothermal power development.

(g) There are hereby transferred to and vested in the Administrator such functions of the Environmental Protection Agency and the officers and components thereof as relate to or are utilized in connection with research, development, and demonstration, but not assessment or monitoring for regulatory purposes, of alternative automotive power systems.

(h) To the extent necessary or appropriate to perform functions and carry out programs transferred by this Act, the Administrator and Commission may exercise, in relation to the functions so transferred, any authority or part thereof available by law, including appropriation Acts, to the official or agency from which such functions were transferred.

(i) In the exercise of his responsibilities under section 103, the Administrator shall utilize, with their consent, to the fullest extent he determines advisable the technical and management capabilities of other executive agencies having facilities, personnel, or other resources which can assist or advantageously be expanded to assist in carrying out such responsibilities. The Administrator shall consult with the head of each agency with respect to such facilities, personnel, or other resources, and may assign, with their consent, specific programs or projects in energy research and development as appropriate. In making such assignments under this subsection, the head of each such agency shall insure that—

- (1) such assignments shall be in addition to and not detract from the basic mission responsibilities of the agency, and
- (2) such assignments shall be carried out under such guidance as the Administrator deems appropriate.

ADMINISTRATIVE PROVISIONS

SEC. 103. (a) The Administrator is authorized to prescribe such policies, standards, criteria, procedures, rules, and regulations as he may deem to be necessary or appropriate to perform functions now or hereafter vested in him.

(b) The Administrator shall engage in such policy planning, and perform such program evaluation analyses and other studies, as may be necessary to promote the efficient and coordinated administration of the Administration and properly assess progress toward the achievement of its missions.

(c) Except as otherwise expressly provided by law, the Administrator may delegate any of his functions to such officers and employees of the Administration as he may designate, and may authorize such successive redelegations of such functions as he may deem to be necessary or appropriate.

(d) Except as provided in section 102 and in section 104(d), the Administrator may organize the Administration as he may deem to be necessary or appropriate.

(e) The Administrator is authorized to establish, maintain, alter, or discontinue such State, regional, district, local, or other field offices as he may deem to be necessary or appropriate to perform functions now or hereafter vested in him.

88 STAT. 1238

Report to
President and
Congress.National
Science
Foundation
functions.Environmental
Protection
Agency
functions.Use of other
agencies'
capabilities.Regulations.
42 USC 5915.Policy plan-
ning and
evaluation.Delegation of
functions.

Organization.

Field offices.

88 STAT. 1239

Seal.

(f) The Administrator shall cause a seal of office to be made for the Administration of such device as he shall approve, and judicial notice shall be taken of such seal.

Working capital fund.

(g) The Administrator is authorized to establish a working capital fund, to be available without fiscal year limitation, for expenses necessary for the maintenance and operation of such common administrative services as he shall find to be desirable in the interests of economy and efficiency. There shall be transferred to the fund the stocks of supplies, equipment, assets other than real property, liabilities, and unpaid obligations relating to the services which he determines will be performed through the fund. Appropriations to the fund, in such amounts as may be necessary to provide additional working capital, are authorized. The working capital fund shall recover, from the appropriations and funds for which services are performed, either in advance or by way of reimbursement, amounts which will approximate the costs incurred, including the accrual of annual leave and the depreciation of equipment. The fund shall also be credited with receipts from the sale or exchange of its property, and receipts in payment for loss or damage to property owned by the fund.

Information from other agencies.

(h) Each department, agency, and instrumentality of the executive branch of the Government is authorized to furnish to the Administrator, upon his request, any information or other data which the Administrator deems necessary to carry out his duties under this title.

PERSONNEL AND SERVICES

Appointment and pay.

42 USC 5816.

SEC. 106. (a) The Administrator is authorized to select, appoint, employ, and fix the compensation of such officers and employees, including attorneys, pursuant to section 161 d. of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2201(d)) as are necessary to perform the functions now or hereafter vested in him and to prescribe their functions.

Experts and consultants.

(b) The Administrator is authorized to obtain services as provided by section 3109 of title 5 of the United States Code.

Military personnel.

(c) The Administrator is authorized to provide for participation of military personnel in the performance of his functions. Members of the Army, the Navy, the Air Force, or the Marine Corps may be detailed for service in the Administration by the appropriate military Secretary, pursuant to cooperative agreements with the Secretary, for service in the Administration in positions other than a position the occupant of which must be approved by and with the advice and consent of the Senate.

(d) Appointment, detail, or assignment to, acceptance of, and service in, any appointive or other position in the Administration under this section shall in no way affect the status, office, rank, or grade which such officers or enlisted men may occupy or hold, or any emolument, perquisite, right, privilege, or benefit incident to or arising out of any such status, office, rank, or grade. A member so appointed, detailed, or assigned shall not be subject to direction or control by his Armed Force, or any officer thereof, directly or indirectly, with respect to the responsibilities exercised in the position to which appointed, detailed, or assigned.

Transportation and per diem.

(e) The Administrator is authorized to pay transportation expenses, and per diem in lieu of subsistence expenses, in accordance with chapter 57 of title 5 of the United States Code for travel between places of recruitment and duty, and while at places of duty, of persons appointed for emergency, temporary, or seasonal services in the field service of the Administration.

(f) The Administrator is authorized to utilize, on a reimbursable basis, the services of any personnel made available by any department, agency, or instrumentality, including any independent agency of the Government.

Personnel of
other agencies.

(g) The Administrator is authorized to establish advisory boards, in accordance with the provisions of the Federal Advisory Committee Act (Public Law 92-463), to advise with and make recommendations to the Administrator on legislation, policies, administration, research, and other matters.

Advisory boards.

5 USC app. I.

(h) The Administrator is authorized to employ persons who are not citizens of the United States in expert, scientific, technical, or professional capacities whenever he deems it in the public interest.

Noncitizens.

POWERS

SEC. 107. (a) The Administrator is authorized to exercise his powers in such manner as to insure the continued conduct of research and development and related activities in areas or fields deemed by the Administrator to be pertinent to the acquisition of an expanded fund of scientific, technical, and practical knowledge in energy matters. To this end, the Administrator is authorized to make arrangements (including contracts, agreements, and loans) for the conduct of research and development activities with private or public institutions or persons, including participation in joint or cooperative projects of a research, developmental, or experimental nature; to make payments (in lump sum or installments, and in advance or by way of reimbursement, with necessary adjustments on account of overpayments or underpayments); and generally to take such steps as he may deem necessary or appropriate to perform functions now or hereafter vested in him. Such functions of the Administrator under this Act as are applicable to the nuclear activities transferred pursuant to this title shall be subject to the provisions of the Atomic Energy Act of 1954, as amended, and to other authority applicable to such nuclear activities. The nonnuclear responsibilities and functions of the Administrator referred to in sections 103 and 104 of this Act shall be carried out pursuant to the provisions of this Act, applicable authority existing immediately before the effective date of this Act, or in accordance with the provisions of chapter 4 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2051-2053).

Research and
development.
42 USC 5817.

Contracts, etc.

42 USC 2011
note.

(b) Except for public buildings as defined in the Public Buildings Act of 1959, as amended, and with respect to leased space subject to the provisions of Reorganization Plan Numbered 18 of 1950, the Administrator is authorized to acquire (by purchase, lease, condemnation, or otherwise), construct, improve, repair, operate, and maintain facilities and real property as the Administrator deems to be necessary in and outside of the District of Columbia. Such authority shall apply only to facilities required for the maintenance and operation of laboratories, research and testing sites and facilities, quarters, and related accommodations for employees and dependents of employees of the Administration, and such other special-purpose real property as the Administrator deems to be necessary in and outside the District of Columbia. Title to any property or interest therein, real, personal, or mixed, acquired pursuant to this section, shall be in the United States.

Facilities and
real property.
40 USC 601 note.
5 USC app. II.

(c)(1) The Administrator is authorized to provide, construct, or maintain, as necessary and when not otherwise available, the following for employees and their dependents stationed at remote locations:

Services for
employees at
remote loca-
tions.

(A) Emergency medical services and supplies.

(B) Food and other subsistence supplies.

(C) Messing facilities.

(D) Audiovisual equipment, accessories, and supplies for recreation and training.

(E) Reimbursement for food, clothing, medicine, and other supplies furnished by such employees in emergencies for the temporary relief of distressed persons.

(F) Living and working quarters and facilities.

(G) Transportation for school-age dependents of employees to the nearest appropriate educational facilities.

(2) The furnishing of medical treatment under subparagraph (A) of paragraph (1) and the furnishing of services and supplies under paragraphs (B) and (C) of paragraph (1) shall be at prices reflecting reasonable value as determined by the Administrator.

(3) Proceeds from reimbursements under this section shall be deposited in the Treasury and may be withdrawn by the Administrator to pay directly the cost of such work or services, to repay or make advances to appropriations or funds which do or will bear all or a part of such cost, or to refund excess sums when necessary; except that such payments may be credited to a service or working capital fund otherwise established by law, and used under the law governing such funds, if the fund is available for use by the Administrator for performing the work or services for which payment is received.

Acquisition of
copyrights,
patents, etc.

(d) The Administrator is authorized to acquire any of the following described rights if the property acquired thereby is for use in, or is useful to, the performance of functions vested in him:

(1) Copyrights, patents, and applications for patents, designs, processes, specifications, and data.

(2) Licenses under copyrights, patents, and applications for patents.

(3) Releases, before suit is brought, for past infringement of patents or copyrights.

Dissemination of
information.

(e) Subject to the provisions of chapter 12 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2161-2166), and other applicable law, the Administrator shall disseminate scientific, technical, and practical information acquired pursuant to this title through information programs and other appropriate means, and shall encourage the dissemination of scientific, technical, and practical information relating to energy so as to enlarge the fund of such information and to provide that free interchange of ideas and criticism which is essential to scientific and industrial progress and public understanding.

Gifts and
bequests.

(f) The Administrator is authorized to accept, hold, administer, and utilize gifts, and bequests of property, both real and personal, for the purpose of aiding or facilitating the work of the Administration. Gifts and bequests of money and proceeds from sales of other property received as gifts or bequests shall be deposited in the Treasury and shall be disbursed upon the order of the Administrator. For the purposes of Federal income, estate, and gift taxes, property accepted under this section shall be considered as a gift or bequest to the United States.

INTERIM COORDINATION

Energy Resources
Council,
establishment.
42 USC 5812.

SEC. 108. (a) There is established in the Executive Office of the President an Energy Resources Council. The Council shall be composed of the Secretary of the Interior, the Administrator of the Federal Energy Administration, the Administrator of the Energy Research and Development Administration, the Secretary of State, the Director, Office of Management and Budget, and such other officials of the Federal Government as the President may designate. The President shall designate one of the members of the Council to serve as Chairman.

(b) It shall be the duty and function of the Council to—

(1) insure communication and coordination among the agencies of the Federal Government which have responsibilities for the development and implementation of energy policy or for the management of energy resources;

(2) make recommendations to the President and to the Congress for measures to improve the implementation of Federal energy policies or the management of energy resources with particular emphasis upon policies and activities involving two or more Departments or independent agencies; and

(3) advise the President in the preparation of the reorganization recommendations required by section 110 of this Act.

(c) The Chairman of the Council may not refuse to testify before the Congress or any duly authorized committee thereof regarding the duties of the Council or other matters concerning interagency coordination of energy policy and activities. Testimony before Congress.

(d) This section shall be effective no later than sixty days after the enactment of this Act or such earlier date as the President shall prescribe and publish in the Federal Register, and shall terminate upon enactment of a permanent department responsible for energy and natural resources or two years after such effective date, whichever shall occur first. Effective date.
Publication in
Federal Register.

FUTURE REORGANIZATION

SEC. 109. (a) The President shall transmit to the Congress as promptly as possible, but not later than June 30, 1975, such additional recommendations as he deems advisable for organization of energy and related functions in the Federal Government, including, but not limited to, whether or not there shall be established (1) a Department of Energy and Natural Resources, (2) an Energy Policy Council, and (3) a consolidation in whole or in part of regulatory functions concerning energy. Report to
Congress.
42 USC 5819.

(b) This report shall replace and serve the purposes of the report required by section 15(a)(4) of the Federal Energy Administration Act. Ante, p. 109.

COORDINATION WITH ENVIRONMENTAL EFFORTS

SEC. 110. The Administrator is authorized to establish programs to utilize research and development performed by other Federal agencies to minimize the adverse environmental effects of energy projects. The Administrator of the Environmental Protection Agency, as well as other affected agencies and departments, shall cooperate fully with the Administrator in establishing and maintaining such programs, and in establishing appropriate interagency agreements to develop cooperative programs and to avoid unnecessary duplication. 42 USC 5820.

TITLE II—NUCLEAR REGULATORY COMMISSION

ESTABLISHMENT AND TRANSFERS

SEC. 201. (a) There is established an independent regulatory commission to be known as the Nuclear Regulatory Commission which shall be composed of five members, each of whom shall be a citizen of the United States. The President shall designate one member Members and
Chairman.
42 USC 5841.

of the Commission as Chairman thereof to serve as such during the pleasure of the President. The Chairman may from time to time designate any other member of the Commission as Acting Chairman to act in the place and stead of the Chairman during his absence. The Chairman (or the Acting Chairman in the absence of the Chairman) shall preside at all meetings of the Commission and a quorum for the transaction of business shall consist of at least three members present. Each member of the Commission, including the Chairman, shall have equal responsibility and authority in all decisions and actions of the Commission, shall have full access to all information relating to the performance of his duties or responsibilities, and shall have one vote. Action of the Commission shall be determined by a majority vote of the members present. The Chairman (or Acting Chairman in the absence of the Chairman) shall be the official spokesman of the Commission in its relations with the Congress, Government agencies, persons, or the public, and, on behalf of the Commission, shall see to the faithful execution of the policies and decisions of the Commission, and shall report thereon to the Commission from time to time or as the Commission may direct. The Commission shall have an official seal which shall be judicially noticed.

Seal.

(b) (1) Members of the Commission shall be appointed by the President, by and with the advice and consent of the Senate.

(2) Appointments of members pursuant to this subsection shall be made in such a manner that not more than three members of the Commission shall be members of the same political party.

(c) Each member shall serve for a term of five years, each such term to commence on July 1, except that of the five members first appointed to the Commission, one shall serve for one year, one for two years, one for three years, one for four years, and one for five years, to be designated by the President at the time of appointment.

Submission
of appoint-
ments to
Senate.

(d) Such initial appointments shall be submitted to the Senate within sixty days of the signing of this Act. Any individual who is serving as a member of the Atomic Energy Commission at the time of the enactment of this Act, and who may be appointed by the President to the Commission, shall be appointed for a term designated by the President, but which term shall terminate not later than the end of his present term as a member of the Atomic Energy Commission, without regard to the requirements of subsection (b) (2) of this section. Any subsequent appointment of such individuals shall be subject to the provisions of this section.

(e) Any member of the Commission may be removed by the President for inefficiency, neglect of duty, or malfeasance in office. No member of the Commission shall engage in any business, vocation, or employment other than that of serving as a member of the Commission.

Transfer of
AEC functions
and personnel.

(f) There are hereby transferred to the Commission all the licensing and related regulatory functions of the Atomic Energy Commission, the Chairman and members of the Commission, the General Counsel, and other officers and components of the Commission—which functions, officers, components, and personnel are excepted from the transfer to the Administrator by section 104(c) of this Act.

Additional
transfers.

(g) In addition to other functions and personnel transferred to the Commission, there are also transferred to the Commission—

(1) the functions of the Atomic Safety and Licensing Board Panel and the Atomic Safety and Licensing Appeal Board;

(2) such personnel as the Director of the Office of Management and Budget determines are necessary for exercising responsibili-

ties under section 205, relating to, research, for the purpose of confirmatory assessment relating to licensing and other regulation under the provisions of the Atomic Energy Act of 1954, as amended, and of this Act.

42 USC 2011
note.

LICENSING AND RELATED REGULATORY FUNCTIONS RESPECTING SELECTED
ADMINISTRATION FACILITIES

SEC. 202. Notwithstanding the exclusions provided for in section 110 a. or any other provisions of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2140(a)), the Nuclear Regulatory Commission shall, except as otherwise specifically provided by section 110 b. of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2140(b)), or other law, have licensing and related regulatory authority pursuant to chapters 6, 7, 8, and 10 of the Atomic Energy Act of 1954, as amended, as to the following facilities of the Administration:

42 USC 5842.

(1) Demonstration Liquid Metal Fast Breeder reactors when operated as part of the power generation facilities of an electric utility system, or when operated in any other manner for the purpose of demonstrating the suitability for commercial application of such a reactor.

42 USC 2071-
2112, 2131-
2140.

(2) Other demonstration nuclear reactors—except those in existence on the effective date of this Act—when operated as part of the power generation facilities of an electric utility system, or when operated in any other manner for the purpose of demonstrating the suitability for commercial application of such a reactor.

(3) Facilities used primarily for the receipt and storage of high-level radioactive wastes resulting from activities licensed under such Act.

(4) Retrievable Surface Storage Facilities and other facilities authorized for the express purpose of subsequent long-term storage of high-level radioactive waste generated by the Administration, which are not used for, or are part of, research and development activities.

OFFICE OF NUCLEAR REACTOR REGULATION

SEC. 203. (a) There is hereby established in the Commission an Office of Nuclear Reactor Regulation under the direction of a Director of Nuclear Reactor Regulation, who shall be appointed by the Commission, who may report directly to the Commission, as provided in section 209, and who shall serve at the pleasure of and be removable by the Commission.

Establishment.
42 USC 5843.
Director.

(b) Subject to the provisions of this Act, the Director of Nuclear Reactor Regulation shall perform such functions as the Commission shall delegate including:

Functions.

(1) Principal licensing and regulation involving all facilities, and materials licensed under the Atomic Energy Act of 1954, as amended, associated with the construction and operation of nuclear reactors licensed under the Atomic Energy Act of 1954, as amended;

42 USC 2011
note.

(2) Review the safety and safeguards of all such facilities, materials, and activities, and such review functions shall include, but not be limited to—

(A) monitoring, testing and recommending upgrading of systems designed to prevent substantial health or safety hazards; and

(B) evaluating methods of transporting special nuclear and other nuclear materials and of transporting and storing high-level radioactive wastes to prevent radiation hazards to employees and the general public.

(3) Recommend research necessary for the discharge of the functions of the Commission.

(c) Nothing in this section shall be construed to limit in any way the functions of the Administration relating to the safe operation of all facilities resulting from all activities within the jurisdiction of the Administration pursuant to this Act.

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

Establishment.
42 USC 5844.
Director.

SEC. 204. (a) There is hereby established in the Commission an Office of Nuclear Material Safety and Safeguards under the direction of a Director of Nuclear Material Safety and Safeguards, who shall be appointed by the Commission, who may report directly to the Commission as provided in section 209, and who shall serve at the pleasure of and be removable by the Commission.

Functions.

(b) Subject to the provisions of this Act, the Director of Nuclear Material Safety and Safeguards shall perform such functions as the Commission shall delegate including:

42 USC 2011
note.

① Principal licensing and regulation involving all facilities and materials, licensed under the Atomic Energy Act of 1954, as amended, associated with the processing, transport, and handling of nuclear materials, including the provision and maintenance of safeguards against threats, thefts, and sabotage of such licensed facilities, and materials.

(2) Review safety and safeguards of all such facilities and materials licensed under the Atomic Energy Act of 1954, as amended, and such review shall include, but not be limited to—

① monitoring, testing, and recommending upgrading of internal accounting systems for special nuclear and other nuclear materials licensed under the Atomic Energy Act of 1954, as amended;

(B) developing, in consultation and coordination with the Administration, contingency plans for dealing with threats, thefts, and sabotage relating to special nuclear materials, high-level radioactive wastes and nuclear facilities resulting from all activities licensed under the Atomic Energy Act of 1954, as amended;

Report to
Congress.

(C) assessing the need for, and the feasibility of, establishing a security agency within the office for the performance of the safeguards functions, and a report with recommendations on this matter shall be prepared within one year of the effective date of this Act and promptly transmitted to the Congress by the Commission.

(3) Recommending research to enable the Commission to more effectively perform its functions.

(c) Nothing in this section shall be construed to limit in any way the functions of the Administration relating to the safeguarding of special nuclear materials, high-level radioactive wastes and nuclear

facilities resulting from all activities within the jurisdiction of the Administration pursuant to this Act.

OFFICE OF NUCLEAR REGULATORY RESEARCH

SEC. 205. (a) There is hereby established in the Commission an Office of Nuclear Regulatory Research under the direction of a Director of Nuclear Regulatory Research, who shall be appointed by the Commission, who may report directly to the Commission as provided in section 209, and who shall serve at the pleasure of and be removable by the Commission.

Establishment.
42 USC 5845.
Director.

(b) Subject to the provisions of this Act, the Director of Nuclear Regulatory Research shall perform such functions as the Commission shall delegate including:

Functions.

(1) Developing recommendations for research deemed necessary for performance by the Commission of its licensing and related regulatory functions.

(2) Engaging in or contracting for research which the Commission deems necessary for the performance of its licensing and related regulatory functions.

(c) The Administrator of the Administration and the head of every other Federal agency shall—

Cooperation of
Federal agencies.

(1) cooperate with respect to the establishment of priorities for the furnishing of such research services as requested by the Commission for the conduct of its functions;

(2) furnish to the Commission, on a reimbursable basis, through their own facilities or by contract or other arrangement, such research services as the Commission deems necessary and requests for the performance of its functions; and

(3) consult and cooperate with the Commission on research and development matters of mutual interest and provide such information and physical access to its facilities as will assist the Commission in acquiring the expertise necessary to perform its licensing and related regulatory functions.

(d) Nothing in subsections (a) and (b) of this section or section 201 of this Act shall be construed to limit in any way the functions of the Administration relating to the safety of activities within the jurisdiction of the Administration.

(e) Each Federal agency, subject to the provisions of existing law, shall cooperate with the Commission and provide such information and research services, on a reimbursable basis, as it may have or be reasonably able to acquire.

Information and
research ser-
vices.

NONCOMPLIANCE

SEC. 206. (a) Any individual director, or responsible officer of a firm constructing, owning, operating, or supplying the components of any facility or activity which is licensed or otherwise regulated pursuant to the Atomic Energy Act of 1954 as amended, or pursuant to this Act, who obtains information reasonably indicating that such facility or activity or basic components supplied to such facility or activity—

42 USC 5846.

(1) fails to comply with the Atomic Energy Act of 1954, as amended, or any applicable rule, regulation, order, or license of the Commission relating to substantial safety hazards, or

42 USC 2011
note.

(2) contains a defect which could create a substantial safety hazard, as defined by regulations which the Commission shall promulgate,

shall immediately notify the Commission of such failure to comply, or of such defect, unless such person has actual knowledge that the Commission has been adequately informed of such defect or failure to comply.

Penalty. (b) Any person who knowingly and consciously fails to provide the notice required by subsection (a) of this section shall be subject to a civil penalty in an amount equal to the amount provided by section 234 of the Atomic Energy Act of 1954, as amended.

42 USC 2282. **Posting of requirements.** (c) The requirements of this section shall be prominently posted on the premises of any facility licensed or otherwise regulated pursuant to the Atomic Energy Act of 1954, as amended.

42 USC 2011 **note.** (d) The Commission is authorized to conduct such reasonable inspections and other enforcement activities as needed to insure compliance with the provisions of this section.

Enforcement.

NUCLEAR ENERGY CENTER SITE SURVEY

42 USC 5847. **Sec. 207.** (a)(1) The Commission is authorized and directed to make or cause to be made under its direction, a national survey, which shall include consideration of each of the existing or future electric reliability regions, or other appropriate regional areas, to locate and identify possible nuclear energy center sites. This survey shall be conducted in cooperation with other interested Federal, State, and local agencies, and the views of interested persons, including electric utilities, citizens' groups, and others, shall be solicited and considered.

Federal-State-local cooperation. (2) For purposes of this section, the term "nuclear energy center site" means any site, including a site not restricted to land, large enough to support utility operations or other elements of the total nuclear fuel cycle, or both including, if appropriate, nuclear fuel reprocessing facilities, nuclear fuel fabrication plants, retrievable nuclear waste storage facilities, and uranium enrichment facilities.

Solicitation of views. (3) The survey shall include—

Definition. (a) a regional evaluation of natural resources, including land, air, and water resources, available for use in connection with nuclear energy center sites; estimates of future electric power requirements that can be served by each nuclear energy center site; an assessment of the economic impact of each nuclear energy site; and consideration of any other relevant factors, including but not limited to population distribution, proximity to electric load centers and to other elements of the fuel cycle, transmission line rights-of-way, and the availability of other fuel resources;

(b) an evaluation of the environmental impact likely to result from construction and operation of such nuclear energy centers, including an evaluation whether such nuclear energy centers will result in greater or lesser environmental impact than separate siting of the reactors and/or fuel cycle facilities; and

(c) consideration of the use of federally owned property and other property designated for public use, but excluding national parks, national forests, national wilderness areas, and national historic monuments.

Report to Congress and Council on Environmental Quality; public availability. (4) A report of the results of the survey shall be published and transmitted to the Congress and the Council on Environmental Quality not later than one year from the date of the enactment of this Act and shall be made available to the public, and shall be updated from time to time thereafter as the Commission, in its discretion, deems advisable. The report shall include the Commission's evaluation of the results of the survey and any conclusions and recommendations, including recommendations for legislation, which the Commission may have concerning the feasibility and practicality of locating nuclear power reactors and/or other elements of the nuclear fuel cycle

on nuclear energy center sites. The Commission is authorized to adopt policies which will encourage the location of nuclear power reactors and related fuel cycle facilities on nuclear energy center sites insofar as practicable.

ABNORMAL OCCURRENCE REPORTS

SEC. 208. The Commission shall submit to the Congress each quarter a report listing for that period any abnormal occurrences at or associated with any facility which is licensed or otherwise regulated pursuant to the Atomic Energy Act of 1954 as amended, or pursuant to this Act. For the purposes of this section an abnormal occurrence is an unscheduled incident or event which the Commission determines is significant from the standpoint of public health or safety. Nothing in the preceding sentence shall limit the authority of a court to review the determination of the Commission. Each such report shall contain—

- (1) the date and place of each occurrence;
- (2) the nature and probable consequence of each occurrence;
- (3) the cause or causes of each; and
- (4) any action taken to prevent recurrence;

the Commission shall also provide as wide dissemination to the public of the information specified in clauses (1) and (2) of this section as reasonably possible within fifteen days of its receiving information of each abnormal occurrence and shall provide as wide dissemination to the public as reasonably possible of the information specified in clauses (3) and (4) as soon as such information becomes available to it.

Reports to
Congress.
42 USC 5848.
42 USC 2011
note.

Public dissemination of
information.

OTHER OFFICERS

SEC. 209. (a) The Commission shall appoint an Executive Director for Operations, who shall serve at the pleasure of and be removable by the Commission.

(b) The Executive Director shall perform such functions as the Commission may direct, except that the Executive Director shall not limit the authority of the director of any component organization provided in this Act to communicate with or report directly to the Commission when such director of a component organization deems it necessary to carry out his responsibilities.

(c) There shall be in the Commission not more than five additional officers appointed by the Commission. The positions of such officers shall be considered career positions and be subject to subsection 161 d. of the Atomic Energy Act.

Executive
Director.
42 USC 5849.
Functions.

Other officers.
42 USC 2201.

TITLE III—MISCELLANEOUS AND TRANSITIONAL PROVISIONS

TRANSITIONAL PROVISIONS

SEC. 301. (a) Except as otherwise provided in this Act, whenever all of the functions or programs of an agency, or other body, or any component thereof, affected by this Act, have been transferred from that agency, or other body, or any component thereof by this Act, the agency, or other body, or component thereof shall lapse. If an agency, or other body, or any component thereof, lapses pursuant to the preceding sentence, each position and office therein which was expressly authorized by law, or the incumbent of which was authorized to receive compensation at the rate prescribed for an office or position at level II, III, IV, or V of the Executive Schedule (5 U.S.C. 5313-5316), shall lapse.

Lapses of agencies and positions.
42 USC 5871.

Savings clauses.

(b) All orders, determinations, rules, regulations, permits, contracts, certificates, licenses, and privileges—

(1) which have been issued, made, granted, or allowed to become effective by the President, any Federal department or agency or official thereof, or by a court of competent jurisdiction, in the performance of functions which are transferred under this Act, and

(2) which are in effect at the time this Act takes effect, shall continue in effect according to their terms until modified, terminated, superseded, set aside, or revoked by the President, the Administrator, the Commission, or other authorized officials, a court of competent jurisdiction, or by operation of law.

(c) The provisions of this Act shall not affect any proceeding pending, at the time this section takes effect, before the Atomic Energy Commission or any department or agency (or component thereof) functions of which are transferred by this Act; but such proceedings, to the extent that they relate to functions so transferred, shall be continued. Orders shall be issued in such proceedings, appeals shall be taken therefrom, and payments shall be made pursuant to such orders, as if this Act had not been enacted; and orders issued in any such proceedings shall continue in effect until modified, terminated, superseded, or revoked by a duly authorized official, by a court of competent jurisdiction, or by operation of law. Nothing in this subsection shall be deemed to prohibit the discontinuance or modification of any such proceeding under the same terms and conditions and to the same extent that such proceeding could have been discontinued if this Act had not been enacted.

(d) Except as provided in subsection (f)—

(1) the provisions of this Act shall not affect suits commenced prior to the date this Act takes effect, and

(2) in all such suits proceedings shall be had, appeals taken, and judgments rendered, in the same manner and effect as if this Act had not been enacted.

(e) No suit, action, or other proceeding commenced by or against any officer in his official capacity as an officer of any department or agency, functions of which are transferred by this Act, shall abate by reason of the enactment of this Act. No cause of action by or against any department or agency, functions of which are transferred by this Act, or by or against any officer thereof in his official capacity shall abate by reason of the enactment of this Act. Causes of actions, suits, actions, or other proceedings may be asserted by or against the United States or such official as may be appropriate and, in any litigation pending when this section takes effect, the court may at any time, on its own motion or that of any party, enter any order which will give effect to the provisions of this section.

(f) If, before the date on which this Act takes effect, any department or agency, or officer thereof in his official capacity, is a party to a suit, and under this Act any function of such department, agency, or officer is transferred to the Administrator or Commission, or any other official, then such suit shall be continued as if this Act had not been enacted, with the Administrator or Commission, or other official, as the case may be, substituted.

(g) Final orders and actions of any official or component in the performance of functions transferred by this Act shall be subject to judicial review to the same extent and in the same manner as if such orders or actions had been made or taken by the officer, department, agency, or instrumentality in the performance of such functions immediately preceding the effective date of this Act. Any statutory requirements relating to notices, hearings, action upon the record, or administrative review that apply to any function transferred by

this Act shall apply to the performance of those functions by the Administrator or Commission, or any officer or component.

(h) With respect to any function transferred by this Act and performed after the effective date of this Act, reference in any other law to any department or agency, or any officer or office, the functions of which are so transferred, shall be deemed to refer to the Administration, the Administrator or Commission, or other office or official in which this Act vests such functions.

(i) Nothing contained in this Act shall be construed to limit, curtail, abolish, or terminate any function of the President which he had immediately before the effective date of this Act; or to limit, curtail, abolish, or terminate his authority to perform such function; or to limit, curtail, abolish, or terminate his authority to delegate, redelegate, or terminate any delegation of functions.

(j) Any reference in this Act to any provision of law shall be deemed to include, as appropriate, references thereto as now or hereafter amended or supplemented.

(k) Except as may be otherwise expressly provided in this Act, all functions expressly conferred by this Act shall be in addition to and not in substitution for functions existing immediately before the effective date of this Act and transferred by this Act.

TRANSFER OF PERSONNEL AND OTHER MATTERS

SEC. 302. (a) Except as provided in the next sentence, the personnel employed in connection with, and the personnel positions, assets, liabilities, contracts, property, records, and unexpended balances of appropriations, authorizations, allocations, and other funds employed, held, used, arising from, available to or to be made available in connection with the functions and programs transferred by this Act, are, subject to section 202 of the Budget and Accounting Procedures Act of 1950 (31 U.S.C. 581c), correspondingly transferred for appropriate allocation. Personnel positions expressly created by law, personnel occupying those positions on the effective date of this Act, and personnel authorized to receive compensation at the rate prescribed for offices and positions at levels II, III, IV, or V of the Executive Schedule (5 U.S.C. 5313-5316) on the effective date of this Act shall be subject to the provisions of subsection (c) of this section and section 301 of this Act.

42 USC 5872.

(b) Except as provided in subsection (c), transfer of nontemporary personnel pursuant to this Act shall not cause any such employee to be separated or reduced in grade or compensation for one year after such transfer.

(c) Any person who, on the effective date of this Act, held a position compensated in accordance with the Executive Schedule prescribed in chapter 53 of title 5 of the United States Code, and who, without a break in service, is appointed in the Administration to a position having duties comparable to those performed immediately preceding his appointment shall continue to be compensated in his new position at not less than the rate provided for his previous position.

INCIDENTAL DISPOSITIONS

SEC. 303. The Director of the Office of Management and Budget is authorized to make such additional incidental dispositions of personnel, personnel positions, assets, liabilities, contracts, property, records, and unexpended balances of appropriations, authorizations, allocations, and other funds held, used, arising from, available to or to be

42 USC 5873.

made available in connection with functions transferred by this Act, as he may deem necessary or appropriate to accomplish the intent and purpose of this Act.

DEFINITIONS

42 USC 5874.

SEC. 304. As used in this Act—

(1) any reference to “function” or “functions” shall be deemed to include references to duty, obligation, power, authority, responsibility, right, privilege, and activity, or the plural thereof, as the case may be; and

(2) any reference to “perform” or “performance”, when used in relation to functions, shall be deemed to include the exercise of power, authority, rights, and privileges.

AUTHORIZATION OF APPROPRIATIONS

42 USC 5875.

SEC. 305. (a) Except as otherwise provided by law, appropriations made under this Act shall be subject to annual authorization.

(b) Authorization of appropriations to the Commission shall reflect the need for effective licensing and other regulation of the nuclear power industry in relation to the growth of such industry.

COMPTROLLER GENERAL AUDIT

42 USC 5876.

42 USC 2206.

Ante, pp. 1234,
1242.

SEC. 306. (a) Section 166. “Comptroller General Audit” of the Atomic Energy Act of 1954, as amended, shall be deemed to be applicable, respectively, to the nuclear and nonnuclear activities under title I and to the activities under title II.

(b) The Comptroller General of the United States shall audit, review, and evaluate the implementation of the provisions of title II of this Act by the Nuclear Safety and Licensing Commission not later than sixty months after the effective date of this Act, the Comptroller General shall prepare and submit to the Congress a report on his audit, which shall contain, but not be limited to—

Report to
Congress.

(1) an evaluation of the effectiveness of the licensing and related regulatory activities of the Commission and the operations of the Office of Nuclear Safety Research and the Bureau of Nuclear Materials Security;

(2) an evaluation of the effect of such Commission activities on the efficiency, effectiveness, and safety with which the activities licensed under the Atomic Energy Act of 1954, as amended, are carried out;

(3) recommendations concerning any legislation he deems necessary, and the reasons therefor, for improving the implementation of title II.

REPORTS

Reports to the
President and
Congress.

42 USC 5877.
Administration
activities and
progress.

SEC. 307. (a) The Administrator shall, as soon as practicable after the end of each fiscal year, make a report to the President for submission to the Congress on the activities of the Administration during the preceding fiscal year. Such report shall include a statement of the short-range and long-range goals, priorities, and plans of the Administration together with an assessment of the progress made toward the attainment of those objectives and toward the more effective and efficient management of the Administration and the coordination of its functions.

Feasibility of
transferring
military
application
functions.

(b) During the first year of operation of the Administration, the Administrator, in collaboration with the Secretary of Defense, shall conduct a thorough review of the desirability and feasibility of trans-

ferring to the Department of Defense or other Federal agencies the functions of the Administrator respecting military application and restricted data, and within one year after the Administrator first takes office the Administrator shall make a report to the President, for submission to the Congress, setting forth his comprehensive analysis, the principal alternatives, and the specific recommendations of the Administrator and the Secretary of Defense.

(c) The Commission shall, as soon as practicable after the end of each fiscal year, make a report to the President for submission to the Congress on the activities of the Commission during the preceding fiscal year. Such report shall include a clear statement of the short-range and long-range goals, priorities, and plans of the Commission as they relate to the benefits, costs, and risks of commercial nuclear power. Such report shall also include a clear description of the Commission's activities and findings in the following areas—

Commission
activities and
findings.

(1) insuring the safe design of nuclear powerplants and other licensed facilities;

(2) investigating abnormal occurrences and defects in nuclear powerplants and other licensed facilities;

(3) safeguarding special nuclear materials at all stages of the nuclear fuel cycle;

(4) investigating suspected, attempted, or actual thefts of special nuclear materials in the licensed sector and developing contingency plans for dealing with such incidents;

(5) insuring the safe, permanent disposal of high-level radioactive wastes through the licensing of nuclear activities and facilities;

(6) protecting the public against the hazards of low-level radioactive emissions from licensed nuclear activities and facilities.

INFORMATION TO COMMITTEES

SEC. 308. The Administrator shall keep the appropriate congressional committees fully and currently informed with respect to all of the Administration's activities.

42 USC 5878.

TRANSFER OF FUNDS

SEC. 309. The Administrator, when authorized in an appropriation Act, may, in any fiscal year, transfer funds from one appropriation to another within the Administration; except, that no appropriation shall be either increased or decreased pursuant to this section by more than 5 per centum of the appropriation for such fiscal year.

42 USC 5879.

CONFORMING AMENDMENTS TO CERTAIN OTHER LAWS

SEC. 310. Subchapter II (relating to Executive Schedule pay rates) of chapter 53 of title 5, United States Code, is amended as follows:

(1) Section 5313 is amended by striking out "(8) Chairman, Atomic Energy Commission." and inserting in lieu thereof "(8) Chairman, Nuclear Regulatory Commission.", and by adding at the end thereof the following:

"(22) Administrator of Energy Research and Development Administration."

(2) Section 5314 is amended by striking out "(42) Members, Atomic Energy Commission." and inserting in lieu thereof "(42) Members, Nuclear Regulatory Commission.", and by adding at the end thereof the following:

"(60) Deputy Administrator, Energy Research and Development Administration."

(3) Section 5315 is amended by striking out paragraph (50), and by adding at the end thereof the following:

"(100) Assistant Administrators, Energy Research and Development Administration (6).

"(101) Director of Nuclear Reactor Regulation, Nuclear Regulatory Commission.

"(102) Director of Nuclear Material Safety and Safeguards, Nuclear Regulatory Commission.

"(103) Director of Nuclear Regulatory Research, Nuclear Regulatory Commission.

"(104) Executive Director for Operations, Nuclear Regulatory Commission."

(4) Section 5316 is amended by striking out paragraphs (29), (62), (69), and (102), by striking out "(81) General Counsel of the Atomic Energy Commission," and inserting in lieu thereof "(81) General Counsel of the Nuclear Regulatory Commission," and by adding at the end thereof the following:

"(134) General Counsel, Energy Research and Development Administration.

"(135) Additional officers, Energy Research and Development Administration (8).

"(136) Additional officers, Nuclear Regulatory Commission (5)."

SEPARABILITY

42 USC 5801
note.

SEC. 311. If any provision of this Act, or the application thereof to any person or circumstance, is held invalid, the remainder of this Act, and the application of such provision to other persons or circumstances, shall not be affected thereby.

EFFECTIVE DATE AND INTERIM APPOINTMENTS

42 USC 5801
note.
Publication in
Federal
Register.

SEC. 312. (a) This Act shall take effect one hundred and twenty days after the date of its enactment, or on such earlier date as the President may prescribe and publish in the Federal Register; except that any of the officers provided for in title I of this Act may be nominated and appointed, as provided by this Act, at any time after the date of enactment of this Act. Funds available to any department or agency (or any official or component thereof), any functions of which are transferred to the Administrator and the Commission by this Act, may, with the approval of the President, be used to pay the compensation and expenses of any officer appointed pursuant to this subsection until such time as funds for that purpose are otherwise available.

(b) In the event that any officer required by this Act to be appointed by and with the advice and consent of the Senate shall not have entered upon office on the effective date of this Act, the President may designate any officer, whose appointment was required to be made by and with the advice and consent of the Senate and who was such an officer immediately prior to the effective date of this Act, to act in such office until the office is filled as provided in this Act. While so acting, such persons shall receive compensation at the rates provided by this Act for the respective offices in which they act.

October 11, 1974

- 21 -

Pub. Law 93-438

88 STAT. 1254

TITLE IV—SEX DISCRIMINATION

SEX DISCRIMINATION PROHIBITED

Sec. 401. No person shall on the ground of sex be excluded from participation in, be denied a license under, be denied the benefits of, or be subjected to discrimination under any program or activity carried on or receiving Federal assistance under any title of this Act. This provision will be enforced through agency provisions and rules similar to those already established, with respect to racial and other discrimination, under title VI of the Civil Rights Act of 1964. However, this remedy is not exclusive and will not prejudice or cut off any other legal remedies available to a discriminatee.

42 USC 5891.

42 USC 2000d.

Approved October 11, 1974.

APPENDIX B

PHYSICAL PROTECTION OF PLANTS AND MATERIALS

UNITED STATES NUCLEAR REGULATORY COMMISSION RULES and REGULATIONS

TITLE 10, CHAPTER 1, CODE OF FEDERAL REGULATIONS—ENERGY

PART 73

PHYSICAL PROTECTION OF PLANTS AND MATERIALS

CENTRAL PROVISIONS

- Sec. 73.1 Purpose and scope.
- 73.2 Definitions.
- 73.3 Interpretations.
- 73.4 Communications.
- 73.5 Specific exemptions.
- 73.6 Exemptions for certain quantities and kinds of special nuclear material.

PHYSICAL PROTECTION OF SPECIAL NUCLEAR MATERIAL IN TRANSIT

- 73.30 General requirements.
- 73.31 Shipment by road.
- 73.32 Shipment by air.
- 73.33 Shipment by rail.
- 73.34 Shipment by sea.
- 73.35 Transfer of special nuclear material.
- 73.36 Miscellaneous requirements.

PHYSICAL PROTECTION REQUIREMENTS AT FIXED SITES

- 73.40 Physical protection: General requirements at fixed sites.
- 73.50 Requirements for physical protection of licensed activities.
- 73.60 Additional requirements for the physical protection of special nuclear material at fixed sites.

RECORDS AND REPORTS

- 73.70 Records.
- 73.71 Reports of unaccounted for shipments, suspected theft, unlawful diversion, or industrial sabotage.

ENFORCEMENT

- 73.80 Violations.
- Appendix A—United States Nuclear Regulatory Commission Inspection and Enforcement Regional Offices.

AUTHORITY: Sec. 161, 68 Stat. 948 (42 U.S.C. 2201). Interpret or apply secs. 53, 163, 68 Stat. 930, 954 (42 U.S.C. 2073, 2233); secs. 202, 206, Pub. L. 93-438, 88 Stat. 1244, 1246 (42 U.S.C. 5842, 5846).

GENERAL PROVISIONS

- § 73.1 Purpose and scope.
- (a) Purpose. This part prescribes requirements for physical protection of special nuclear material at fixed sites and in transit and of plants in which special nuclear material is used, for the purpose of protection against acts of industrial sabotage and protection of special nuclear material against theft by establishment and maintenance of a physical protection system of: (1) Protective barriers and intrusion detection devices at fixed sites to provide early

detection of an attack, (2) deterrence to attack by means of armed guards and escorts, and (3) liaison and communication with law enforcement authorities capable of rendering assistance to counter such attacks.

(b) Scope. (1) This part prescribes requirements for (i) the physical protection of production and utilization facilities licensed pursuant to Part 50 of this chapter; (ii) the physical protection of plants in which activities licensed pursuant to Part 70 of this chapter are conducted; and the physical protection of special nuclear material, by any person who pursuant to the regulations in Part 70 of this chapter processes or uses at any site or contiguous sites subject to control by the licensee, uranium-235 (contained in uranium enriched to 20 percent or more in the U-235 isotope), uranium-233, or plutonium alone or in any combination in a quantity of 5,000 grams or more computed by the formula, grams=(grams contained U-235) + 2.5 (grams U-233 + grams plutonium).

(2) This part prescribes requirements for the physical protection of special nuclear material in transportation by any person who is licensed pursuant to the regulations in Part 70 of this chapter who imports, exports, transports, delivers to a carrier for transport in a single shipment, or takes delivery of a single shipment free on board at the point where it is delivered to a carrier, either uranium-235 (contained in uranium enriched to 20 percent or more in the U-235 isotope), uranium-233, or plutonium, or any combination of these materials, which is 5,000 grams or more computed by the formula, grams=(grams contained U-235) + 2.5 (grams U-233 + grams plutonium).

(3) This part also applies to shipments by air of special nuclear material in quantities exceeding (i) 20 grams or 20 curies, whichever is less, of plutonium or uranium-233, or (ii) 350 grams of uranium-235 (contained in uranium enriched to 20 percent or more in the U-235 isotope).

(4) Special nuclear material subject to this part may also be protected pursuant to security procedures prescribed by the Commission or another Government agency for the protection of classi-

fied materials. The provisions and requirements of this part are in addition to, and not in substitution for, any such security procedures. Compliance with the requirements of this part does not relieve any licensee from any requirement or obligation to protect special nuclear material pursuant to security procedures prescribed by the Commission or other Government agency for the protection of classified materials.

§ 73.2 Definitions.

As used in this part:

(a) Terms defined in Parts 50 and 70 of this chapter have the same meaning when used in this part.

(b) "Authorized individual" means any individual, including an employee, a consultant, or an agent of a licensee, who has been designated in writing by a licensee to have responsibility for surveillance of special nuclear material.

(c) "Guard" means a uniformed individual armed with a firearm whose primary duty is the protection of special nuclear material against theft and/or the protection of a plant against industrial sabotage.

(d) "Watchman" means an individual, not necessarily uniformed or armed with a firearm, who provides protection for a plant and the special nuclear material therein in the course of performing other duties.

(e) "Continuous visual surveillance" means unobstructed view at all times of a shipment of special nuclear material, and of all access to a temporary storage area or cargo compartment containing the shipment.

(f) "Physical barrier" means

(1) Fences constructed of No. 11 American wire gauge, or heavier wire fabric, topped by three strands or more of barbed wire or similar material on brackets angled outward between 30° and 45° from the vertical, with an overall height of not less than eight feet, including the barbed topping.

(2) Building walls constructed of stone, brick, cinder block, concrete, steel or comparable materials (openings in which are secured by gates, doors, or covers of construction and fastening of sufficient strength such that the integrity of the wall is not lessened by any opening), or walls of similar construction, not part of a building, provided with a

* Amended 39 FR 2252.

PART 73 • PHYSICAL PROTECTION OF PLANTS AND MATERIALS

barbed topping described in paragraph (f) (1) of this section of a height of not less than 8 feet.

(3) Ceilings and floors constructed to offer resistance to penetration equivalent to that of building walls described in paragraph (f) (2) of this section.

(g) "Protected area" means an area encompassed by physical barriers and to which access is controlled.

(h) "Vital area" means any area which contains vital equipment within a structure, the walls, roof, and floor of which constitute physical barriers of construction at least as substantial as walls as described in paragraph (f) (2) of this section.

(i) "Vital equipment" means any equipment, system, device, or material, the failure, destruction, or release of which could directly or indirectly endanger the public health and safety by exposure to radiation. Equipment or systems which would be required to function to protect public health and safety following such failure, destruction, or release are also considered to be vital.

(j) "Material access area" means any location which contains special nuclear material, within a vault or a building, the roof, walls, and floor of which each constitute a physical barrier.

(k) "Isolation zone" means any area, clear of all objects which could conceal or shield an individual, adjacent to a physical barrier, which is monitored to detect the presence of individuals or vehicles within that area.

(l) "Intrusion alarm" means a tamper indicating electrical, electromechanical, electrooptical, electronic or similar device which will detect intrusion by an individual into a building, protected area, vital area, or material access area, and alert guards or watchmen by means of actuated visible and audible signals.

(m) "Lock" in the case of vaults or vault type rooms means a three-position, manipulation resistant, dial type, built-in combination lock or combination padlock and in the case of fences, walls, and buildings means an integral door lock or padlock which provides protection equivalent to a six-tumbler cylinder lock. "Lock" in the case of a vault or vault type room also means any manipulation resistant, electromechanical device which provides the same function as a built-in combination lock or combination padlock, which can be operated remotely or by the "reading" or insertion of information, which can be uniquely characterized, and which allows operation of the device. "Locked" means protected by an operable lock.

(n) "Vault" means a burglar-resistant windowless enclosure with walls, floor and roof of: (1) Steel at least one-half inch thick, (2) reinforced concrete or stone at least 8 inches thick, (3) non-reinforced concrete or stone at least 12 inches thick, or (4) monolithic floor or roof construction of equivalent resistance to entry, with a built-in lock in a steel door at least 1 inch thick, exclusive of the locking mechanism.

(o) "Vault-type room" means a room with one or more doors, all capable of being locked, protected by an intrusion alarm, which creates an alarm upon the

entry of a person anywhere into the room and upon exit from the room or upon movement of an individual within the room.

(p) "Industrial sabotage" means any deliberate act directed against a plant in which an activity licensed pursuant to the regulations in this chapter is conducted, or to any component of such a plant, which could directly or indirectly endanger the public health and safety by exposure to radiation, other than such acts by an enemy of the United States, whether foreign government or other person.

(q) "ERDA" means the Energy Research and Development Administration or its duly authorized representatives.

§ 73.3 Interpretations.

Except as specifically authorized by the Commission in writing, no interpretation of the meaning of the regulations in this part by any officer or employee of the Commission other than a written interpretation by the General Counsel will be recognized as binding upon the Commission.

§ 73.4 Communications.

Except where otherwise specified, all communications and reports concerning the regulations in this part should be addressed to the Director of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, or may be delivered in person at the Commission's offices at 1717 H Street, NW, Washington, D.C. at 7920 Norfolk Avenue, Bethesda, Maryland.

§ 73.5 Specific exemptions.

The Commission may, upon application of any interested person or upon its own initiative, grant such exemptions from the requirements of the regulations in this part as it determines are authorized by law and will not endanger life or property or the common defense and security, and are otherwise in the public interest.

§ 73.6 Exemptions for certain quantities and kinds of special nuclear material.

A licensee is exempt from the requirements of §§ 73.30 through 73.36 and of §§ 73.60 and 73.70 of this part, with respect to the following special nuclear material:

(a) Uranium-235 contained in uranium enriched to less than 20 percent in the U-235 isotope;

(b) Special nuclear material which is not readily separable from other radioactive material and which has a total external radiation dose rate in excess of 100 rems per hour at a distance of 3 feet from any accessible surface without intervening shielding; and

(c) Special nuclear material in a quantity not exceeding 350 grams of uranium-235, uranium-233, plutonium, or a combination thereof, possessed in any analytical, research, quality control, metallurgical or electronic laboratory.

PHYSICAL PROTECTION OF SPECIAL NUCLEAR MATERIAL IN TRANSIT

§ 73.30 General requirements.

(a) Except as specified in § 73.36(a) or as otherwise authorized pursuant to § 73.30(f), each licensee who transports or who delivers to a carrier for transport either uranium-235 (contained in uranium enriched to 20 percent or more in the U-235 isotope), uranium-233, or plutonium, or any combination of these materials, which is 5,000 grams or more computed by the formula, grams = (grams contained U-235) + 2.5 (grams U-233 + grams plutonium), shall make arrangements to assure that such special nuclear material will, if a common or contract carrier is used, be transported under the established procedures of a carrier which provides a system for the physical protection of valuable material in transit and requires an exchange of hand-to-hand receipts at origin and destination and at all points enroute where there is a transfer of custody.

(b) Transit times of shipments other than those specified in § 73.1(b) (3) shall be minimized and routes shall be selected to avoid areas of natural disaster or civil disorders. Such shipments shall be preplanned to assure that deliveries occur at a time when the receiver at the final delivery point is present to accept receipt of shipment.

(c) Special nuclear material shall be shipped in containers which are sealed by tamper indicating type seals. The container shall also be locked if it is not in another container or vehicle which is locked. If inspection of the container or vehicle is not required by State or local authorities before final destination, the outermost container or vehicle shall also be sealed by tamper indicating type seals. No container weighing 500 pounds or less shall be shipped in open trucks, railroad flat cars or box cars and ships. This paragraph does not apply to shipments of quantities specified in § 73.1(b), (3).

(d) When guards are used pursuant to § 73.31(c) (1), 73.31(c) (2), 73.33 and 73.35, the licensee shall not permit an individual to act as a guard unless there is documentation that the individual has been qualified by demonstrating an understanding of his duties and responsibilities. The licensee or his agent shall have documentation that guards have been requalified annually.

(e) By January 7, 1974, each licensee shall submit a plan outlining the procedures that will be used to meet the requirements of §§ 73.30 through 73.36 and 73.70(g) including a plan for the selection, qualification, and training of armed escorts, or the specification and design of a specially designed truck or trailer as appropriate. This plan shall be followed by the licensee after March 4, 1974.

(f) A licensee or applicant for a license may apply to the Commission for approval of proposed procedures for transport of special nuclear material in a manner not otherwise authorized by the regulations of this part. Such application shall include a description and quantity of the special nuclear material involved, the origin and destination, the

PART 73 • PHYSICAL PROTECTION OF PLANTS AND MATERIALS

carriers to be used, the expected time in transit, the number of transfer points, the communications to be used, the vehicle's usual identification, and the cargo security and surveillance measures to be used.

(g) Paragraphs (b), (c), (d), and (f) of this section are effective March 6, 1974.

§ 73.31 Shipment by road.

(a) All shipments by road shall be made without any scheduled intermediate stops to transfer special nuclear material or other cargo between the facility from which it is shipped and the facility of the receiver.

(b) All motor vehicles used to transport special nuclear material shall be equipped with a radiotelephone which can communicate with a licensee or his agent. The licensee or agent with whom communications shall be maintained for different segments of the shipment shall be predesignated before a shipment is made. Calls to such licensee or agent shall be made at least every 2 hours when radiotelephone or conventional telephone coverage along the route is available to relay position and projected route. Call frequency may extend up to 5 hours when radiotelephone or conventional telephone coverage is not available along the preplanned route, at which time a conventional telephone call shall be made. In the event no call is received in accordance with these requirements, the licensee or his agent shall immediately notify an appropriate law enforcement authority and the appropriate Nuclear Regulatory Commission Inspection and Enforcement Regional Office listed in Appendix A of this part.

(c) A shipment shall be accompanied by at least two people in the vehicle containing the shipment, which may be two drivers or one driver and an authorized individual. The vehicle containing the shipment shall be under continuous visual surveillance, or one of the drivers or authorized individuals shall be in the cab of the vehicle, awake, and not in a sleeper berth. The shipment shall be further protected by one of the following methods:

(1) An armed escort consisting of at least two guards shall accompany the shipment in a separate escort vehicle. Escorts shall maintain continuous vigilance for the presence of conditions or situations which might threaten the security of the shipment, take such action as circumstances might require to avoid interference with continuous safe passage of the cargo vehicle, provide assistance to, or summon aid for crew of cargo vehicles in case of emergency, check seals and locks at each stop where time permits, and observe the cargo vehicle and adjacent areas during stops or layovers. Continuous radio communication capability shall be provided between the cargo vehicle and the escort vehicle. Escort vehicles shall not be equipped with a radiotelephone. The licensee may use his own equipment as armed escorts or he may use an agent. Only the driver is required

to be in the vehicle containing special nuclear material for the purpose of maintaining an armed escort. If a radiotelephone is maintained during the course of the shipment with the licensee or agent monitoring the shipment.

(2) The shipment shall be made in a specially designed truck or trailer which reduces the vulnerability to diversion. Design features of the truck or trailer shall permit immobilization of the van and provide barriers or deterrents to physical penetration of the cargo compartment unless armed guards are also used in which case immobilization of the vehicle is not required.

(d) Transfers to and from other modes of transportation shall be in accordance with § 73.35.

(e) Vehicles shall be marked on top with identifying letters or numbers which will permit identification of the vehicle under daylight conditions from the air in clear weather at 1,000 feet above ground level. The same code of letters and numbers as those used on the top shall also be marked on the sides and rear of the vehicle to permit identification from the ground.

(f) This section is effective March 6, 1974.

§ 73.32 Shipment by air.

(a) Except as specifically approved by the Nuclear Regulatory Commission, no shipment of special nuclear material shall be made in passenger aircraft in excess of (1) 20 grams or 20 curies, whichever is less, of plutonium or uranium-233, or (2) 350 grams of uranium-235 (contained in uranium enriched to 20 percent or more in the U-235 isotope).

(b) In shipments on cargo aircraft of either uranium-235 (contained in uranium enriched to 20 percent or more in the U-235 isotope), uranium-233 or plutonium, or any combination of these materials which is 5,000 grams or more computed by the formula, grams = (grams contained U-235) + 2.5 (grams U-233 + grams plutonium), transfers shall be in accordance with § 73.35. Transfers shall be minimized.

(c) Export shipments shall be escorted by an unarmed authorized individual, who may be a crew member, from the last terminal in the United States until the shipment is unloaded at a foreign terminal. He shall perform monitoring duties at foreign terminals as described in § 73.35.

(d) Paragraph (c) of this section is effective March 6, 1974.

§ 73.33 Shipment by rail.

(a) A shipment by rail shall be escorted by two guards, in the shipment car or an escort car of the train, who shall keep the shipment cars under observation and who shall detain at stops when practicable and time permits to guard the shipment cars under observation, and check car or container locks and seals. Radiotelephone communication shall be maintained with a licensee or his agent to relay position every 2 hours or less, and at scheduled stops in the event that radiotelephone coverage was not available in the last 5 hours before

the stop. The licensee or agent with whom communications shall be maintained for different segments of the shipment shall be predesignated before a shipment is made. In the event no call is received in accordance with these requirements, the licensee or his agent shall immediately notify an appropriate law enforcement authority and the appropriate Nuclear Regulatory Commission Inspection and Enforcement Regional Office listed in Appendix A of this part.

(b) Transfers shall be in accordance with § 73.35.

(c) This section is effective March 6, 1974.

§ 73.34 Shipment by sea.

(a) Shipments shall be made on vessels making the minimum ports of call. Transfers to and from other modes of transportation shall be in accordance with § 73.35. There shall be no scheduled transfers to other ships. At domestic ports of call where other cargo is transferred, the shipments shall be protected in accordance with § 73.35(a).

(b) The shipment shall be placed in a secure compartment which is locked and sealed. Locks and seals shall be periodically inspected in transit, if accessible, by an escort or crew member.

(c) Export shipments shall be escorted by an unarmed authorized individual, who may be a crew member, from the last port in the United States until the shipment is unloaded at a foreign port. He shall perform monitoring duties at foreign ports as described in § 73.35.

(d) Ship-to-shore communications shall be available, and a ship-to-shore contact shall be made every twenty-four hours to relay position information, and the status of the shipment, which shall be determined by a daily inspection where possible. This information shall be sent, as often as it is available, to the licensee or his agent who makes the arrangements for the protection of the shipment.

(e) This section is effective March 6, 1974.

§ 73.35 Transfer of special nuclear material.

All transfers shall be monitored by a guard. An alternate guard shall be designated at all transfer points to substitute, if necessary. Monitoring of special nuclear material transfers shall be conducted as follows:

(a) At scheduled intermediate stops where special nuclear material is not scheduled for transfer, the guard shall observe the opening of the cargo compartment and assure that the shipment is not removed. The guard shall maintain continuous visual surveillance of the cargo compartment. Continuous visual surveillance of the cargo compartment shall be maintained up to the time the vehicle is ready to depart. The guard shall observe the vehicle until it has departed, and shall notify the licensee or his agent of the latest status immediately thereafter.

(b) At points where special nuclear material is transferred from a vehicle to storage, from one vehicle to another, or from storage to a vehicle, the guard shall keep the shipment under con-

PART 73 • PHYSICAL PROTECTION OF PLANTS AND MATERIALS

tinuous visual surveillance by observing the opening of the cargo compartment of the incoming vehicle and assuring that the shipment is complete by checking locks and/or seals. Continuous visual surveillance of a shipment shall be maintained at all times it is in the terminal or in storage. Shipments shall be pre-planned in order to avoid storage times in excess of 24 hours. Continuous visual surveillance of the cargo compartment shall be maintained up to the time the vehicle is ready to depart from the terminal. The guard shall observe the vehicle until it has departed, and shall notify the licensee or his agent of the latest status immediately thereafter.

(c) The guard shall be required to immediately notify the carrier and the licensee who made the arrangements for protection of special nuclear material of any deviation from or attempted interference with schedule or routing.

(d) This section is effective March 6, 1974.

§ 73.36 Miscellaneous requirements.

(a) Each licensee who takes delivery of special nuclear material free on board (f.o.b.) the point at which it is delivered to a carrier for transport shall make the arrangements to assure that such special nuclear material will be protected in transit as prescribed in §§ 73.30 through 73.35, rather than the person who delivers such shipment to the carrier for transport.

(b) Each licensee who imports special nuclear material shall make arrangements to assure that such material will be protected in transit as follows:

(1) An individual designated by the licensee or his agent, or as specified by a contract of carriage, shall confirm the container count and examine locks and/or seals for evidence of tampering, at the first place in the United States at which the shipment is discharged from the arriving carrier.

(2) The shipment shall be protected at the first terminal at which it arrives in the United States and all subsequent terminals as provided in §§ 73.30 through 73.35 and paragraphs (c) and (f) of this section.

(c) (1) Each licensee who delivers special nuclear material to a carrier for transport shall immediately notify the consignee by telephone, telegraph, or teletype, of the time of departure of the shipment, and shall notify or confirm with the consignee the method of transportation, including the names of carriers, and the estimated time of arrival of the shipment at its destination. (2) In the case of a shipment free on board (f.o.b.) the point where it is delivered to a carrier for transport, each licensee shall, before the shipment is delivered to the carrier, obtain written certification from the licensee who is to take delivery of the shipment at the f.o.b. point that the physical protection arrangements required by §§ 73.30 through 73.35 for licensed shipments have been made. When a contract exempt from the requirements for a Commission license is the consignee of a shipment, the licensee shall, before the shipment is delivered to the carrier, obtain written certification from the contractor who is to take

delivery of the shipment at the f.o.b. point that the physical protection arrangements required by ERDA Manual or NRC Manual (Chapters 2401 or 2405, as appropriate, have been made.

(3) Each licensee who delivers special nuclear material to a carrier for transport shall also make arrangements with the consignee to be notified immediately by telephone, telegraph, or teletype, of the arrival of the shipment at its destination.

(d) In addition to complying with the requirements specified in paragraphs (c) and (f) of this section, each licensee who exports special nuclear material shall comply with the requirements specified in §§ 73.30 through 73.35, as applicable, up to the first point where the shipment is taken off the vehicle outside the United States. The licensee shall also make arrangements with the consignee to be notified immediately by telephone and telegraph, teletype, or cable, of the arrival of the shipment at its destination, or of any such shipment that is lost or unaccounted for after the estimated time of arrival at its destination.

(e) Each licensee who receives a shipment of special nuclear material shall immediately notify the person who delivered the material to a carrier for transport of the arrival of the shipment at its destination. In the event such a shipment fails to arrive at its destination at the estimated time, the consignee, if a licensee, or in the case of an export shipment, the licensee who exported the shipment, shall immediately notify by telephone and telegraph, or teletype, the Director of the appropriate Nuclear Regulatory Commission Inspection and Enforcement

Regional Office listed in Appendix A of this part, and the licensee or other person who delivered the material to a carrier for transport. The licensee who made the physical protection arrangements shall also immediately notify by telephone and telegraph, or teletype the Director of the appropriate Nuclear Regulatory Commission Inspection and Enforcement Regional Office listed in Appendix A of the action being taken to trace the shipment.

(f) Each licensee who makes arrangements for physical protection of a shipment of special nuclear material as required by §§ 73.30 through 73.36 shall immediately conduct a trace investigation of any shipment that is lost or unaccounted for after the estimated arrival time and file a report with the Commission as specified in § 73.71. If the licensee who conducts the trace investigation is not the consignee, he shall also immediately report the results of his investigation by telephone and telegraph, or teletype to the consignee.

(g) Paragraphs (a), (b), (c) and (d) of this section are effective March 6, 1974.

PHYSICAL PROTECTION REQUIREMENTS AT FIXED SITES

§ 73.40 Physical protection: General requirements at fixed sites.

Each licensee shall provide physical protection against industrial sabotage and against theft of special nuclear material at the fixed sites where licensed activities are conducted. Security plans

submitted to the Atomic Energy Commission for approval shall be followed by the licensee after March 6, 1974.

§ 73.50 Requirements for physical protection of licensed activities.

In addition to any other requirements of this part, each licensee who is authorized to operate a fuel reprocessing plant pursuant to Part 50 of this chapter or who possesses or uses uranium-235 (contained in uranium enriched to 20 percent or more in the U-235 isotope), uranium-233, or plutonium alone or in any combination in a quantity of 5000 grams or more computed by the formula, grams = (grams contained U-235) ÷ 2.5 (grams U-233 ÷ grams plutonium), other than in the operation of a nuclear reactor licensed pursuant to Part 50 of this chapter, shall comply with the following:

(a) Physical security organization.

(1) The licensee shall establish a security organization, including guards, to protect his facility against industrial sabotage and the special nuclear material in his possession against theft.

(2) At least one supervisor of the security organization shall be on site at all times.

(3) The licensee shall establish, maintain and follow written security procedures which document the structure of the security organization and which detail the duties of guards, watchmen, and other individuals responsible for security.

(4) The licensee shall not permit an individual to act as a guard or watchman unless such individual has been properly trained and equipped and has qualified by demonstrating: (i) An understanding of the licensee's security procedures, and (ii) the ability to execute all duties required of him by such procedures. Each guard and watchman shall be requalified at least annually. Such requalification shall be documented.

(b) Physical barriers. (1) The licensee shall locate vital equipment only within a vital area, which, in turn, shall be located within a protected area such that access to vital equipment requires passage through at least two physical barriers. More than one vital area may be within a single protected area.

(2) The licensee shall locate material access areas only within protected areas such that access to the material access area requires passage through at least two physical barriers. More than one material access area may be within a single protected area.

(3) The physical barrier at the perimeter of the protected area shall be separated from any other barrier designated as a physical barrier within the protected area, and the intervening space monitored or periodically checked to detect the presence of persons or vehicles so that the facility security organization can respond to suspicious activity or to the breaching of any physical barrier.

(4) An isolation zone shall be maintained around the physical barrier at the perimeter of the protected area and any part of a building used as part of that physical barrier. The isolation zone shall

PART 73 • PHYSICAL PROTECTION OF PLANTS AND MATERIALS

be monitored to detect the presence of individuals or vehicles within the zone so as to allow response by armed members of the licensee security organization to be initiated at the time of penetration of the protected area. Parking facilities, both for employees and visitors, shall be located outside the isolation zone.

(5) Isolation zones and clear areas between barriers shall be provided with illumination sufficient for the monitoring required by paragraph (b) (3) and (4) of this section, but not less than 0.2 foot candles.

(c) **Access requirements.** The licensee shall control all points of personnel and vehicle access into a protected area, including shipping or receiving areas, and into each vital area. Identification of personnel and vehicles shall be made and authorization shall be checked at such points.

(1) At the point of personnel and vehicle access into a protected area, all individuals, except employees who possess an NRC or ERDA personnel security clearance, and all hand-carried packages shall be searched for devices such as firearms, explosives, and incendiary devices, or other items which could be used for industrial sabotage. The search shall be conducted either by a physical search or by the use of equipment capable of detecting such devices. Employees who possess an NRC or ERDA personnel security clearance shall be searched at random intervals. Subsequent to search, drivers of delivery and service vehicles shall be escorted at all times while within the protected area.

(2) All packages being delivered into the protected area shall be checked for proper identification and authorization. Packages other than hand-carried packages shall be searched at random intervals.

(3) A picture badge identification system shall be used for all individuals who are authorized access to protected areas without escort.

(4) Access to vital areas and material access areas shall be limited to individuals who are authorized access to vital equipment or special nuclear material and who require such access to perform their duties. Authorization for such individuals shall be provided by the issuance of specially coded numbered badges indicating vital areas and material access areas to which access is authorized. Unoccupied vital areas and material access areas shall be protected by an active intrusion alarm system.

(5) Individuals not employed by the licensee shall be escorted by a watchman, or other individual designated by the licensee, while in a protected area and shall be badged to indicate that an escort is required. In addition, each individual not employed by the licensee shall be required to register his name, date, time, purpose of visit, employment affiliation, citizenship, name and badge number of the escort, and name of the individual to be visited. Except for a driver of a delivery or service vehicle, an individual not employed by the licensee who requires frequent and extended access to a protected area or a vital area need not be escorted provided such individual is provided with a picture badge, which he must receive upon entrance into the pro-

TECTED area and which he must return each time he leaves the protected area, which indicates (i) nonemployee-no escort required, (ii) areas to which access is authorized, and (iii) the period for which access has been authorized.

(6) No vehicles used primarily for the conveyance of individuals shall be permitted within a protected area except under emergency conditions.

(7) Keys, locks, combinations, and related equipment shall be controlled to minimize the possibility of compromise and promptly changed whenever there is evidence that they have been compromised. Upon termination of employment of any employee, keys, locks, combinations, and related equipment to which that employee had access shall be changed.

(d) **Detection aids.** (1) All alarms required pursuant to this part shall annunciate in a continuously manned central alarm station located within the protected area and in at least one other continuously manned station, not necessarily within the protected area, such that a single act cannot remove the capability of calling for assistance or otherwise responding to an alarm. All alarms shall be self-checking and lamp indicating. The annunciation of an alarm at the onsite central alarm station shall indicate the type of alarm (e.g., intrusion alarm, emergency exit alarm, etc.) and location. All intrusion alarms, emergency exit alarms, alarm systems, and line supervisory systems shall at minimum meet the performance and reliability levels indicated by GSA Interim Federal Specification W-A-00450 B (GSA-FSS).

(2) All emergency exits in each protected area and each vital area shall be alarmed.

(e) **Communication requirements.** (1) Each guard or watchman on duty shall be capable of maintaining continuous communication with an individual in a continuously manned central alarm station within the protected area, who shall be capable of calling for assistance from other guards and watchmen and from local law enforcement authorities.

(2) The alarm stations required by paragraph (d) (1) of this section shall have conventional telephone service for communication with the law enforcement authorities as described in paragraph (e) (1) of this section.

(3) To provide the capability of continuous communication, two-way radio voice communication shall be established in addition to conventional telephone service between local law enforcement authorities and the facility and shall terminate at the facility in a continuously manned central alarm station within the protected area.

(4) All communications equipment, including offsite equipment, shall remain operable from independent power sources in the event of loss of primary power.

(f) **Testing and maintenance.** Each licensee shall test and maintain intrusion alarms, emergency alarms, communications equipment, physical barriers, and other security related devices or equipment utilized pursuant to this section as follows:

(1) All alarms, communications equipment, physical barriers, and other secu-

rity related devices or equipment shall be maintained in operable and effective condition.

(2) Each intrusion alarm shall be functionally tested for operability and required performance at the beginning and end of each interval during which it is used for security, but not less frequently than once every seven (7) days.

(3) Communications and performance shall be tested for operability and performance not less frequently than once at the beginning of each security personnel work shift.

(g) **Response requirement.** (1) The licensee shall establish liaison with local law enforcement authorities. In developing his physical security plan, the licensee shall take account of the probable size and response time of the local law enforcement authority assistance.

(2) Upon detection of abnormal presence or activity of persons or vehicles within an isolation zone, a protected area, a material access area or a vital area, or upon evidence of intrusion into a protected area, a material access area or a vital area, the facility security organization shall (i) determine whether or not a threat exists, (ii) assess the extent of the threat, if any, and (iii) take immediate measures to neutralize the threat, either by appropriate action by facility guards or by calling for assistance from local law enforcement authorities, or both.

(h) This section is effective March 6, 1974.

§ 73.60 Additional requirements for the physical protection of special nuclear material at fixed sites.

In addition to the applicable requirements of § 73.50, each licensee who pursuant to the regulations in Part 70 of this chapter possesses at any site or contiguous sites subject to control by licensee uranium-235 (contained in uranium enriched to 20 percent or more in the U-235 isotope), uranium-233, or plutonium alone or in any combination in a quantity of 5,000 grams or more computed by the formula, $\text{grams} = (\text{grams U-235}) \times 2.5$ (grams U-233 + grams plutonium) shall protect the special nuclear material from theft or diversion as follows:

(a) **Access requirements.** (1) Special nuclear material shall be stored or processed only in a material access area. No activities other than those which require access to special nuclear material or equipment employed in the process, use, or storage of special nuclear material, shall be permitted within a material access area.

(2) Material access areas shall be located only within a protected area to which access is controlled.

(3) Special nuclear material not in process shall be stored in a vault equipped with an intrusion alarm or in a vault-type room, and each such vault or vault-type room shall be controlled as a separate material access area.

(4) Enriched uranium scrap in the form of small pieces, cuttings, chips, solutions or in other forms which result from a manufacturing process, contained in 30-gallon or larger containers, with a uranium-235 content of less than 0.25 grams per liter, may be stored within a

PART 73 • PHYSICAL PROTECTION OF PLANTS AND MATERIALS

locked and separately fenced area which is within a larger protected area provided that the storage area is no closer than 25 feet to the perimeter of the protected area. The storage area when unoccupied shall be protected by a guard or watchman who shall patrol at intervals not exceeding 4 hours, or by intrusion alarms.

(5) Admittance to a material access area shall be under the control of authorized individuals and limited to individuals who require such access to perform their duties.

(6) Prior to entry into a material access area, packages shall be searched for devices such as firearms, explosives, incendiary devices, or counterfeit substitute items which could be used for theft or diversion of special nuclear material.

(7) Methods to observe individuals within material access areas to assure that special nuclear material is not diverted shall be provided and used on a continuing basis.

(b) **Exit requirement.** Each individual, package, and vehicle shall be searched for concealed special nuclear material before exiting from a material access area unless exit is into a contiguous material access area. The search may be carried out by a physical search or by use of equipment capable of detecting the presence of concealed special nuclear material.

(c) **Detection and requirement.** Each unoccupied material access area shall be locked and protected by an intrusion alarm on active status. All emergency exits shall be continuously alarmed.

(d) **Testing and maintenance.** Each licensee shall test and maintain intrusion alarms, physical barriers, and other devices utilized pursuant to the requirements of this section as follows:

(1) Intrusion alarms, physical barriers, and other devices used for material protection shall be maintained in operable condition.

(2) Each intrusion alarm shall be inspected and tested for operability and required functional performance at the beginning and end of each interval during which it is used for material protection, but not less frequently than once every seven (7) days.

(e) This section is effective March 6, 1974.

RECORDS AND REPORTS

§ 73.70 Records.

Each licensee subject to the provisions of §§ 73.30 through 73.36 and/or § 73.50 and/or § 73.60 shall keep the following records:

(a) Names and addresses of all individuals who have been designated as authorized individuals.

(b) Names, addresses, and badge numbers of all individuals authorized to have access to vital equipment or special nuclear material, and the vital areas and material access areas to which authorization is granted.

(c) A register of visitors, vendors, and other individuals not employed by the licensee recorded pursuant to § 73.50(c) (5).

(d) A log indicating name, badge number, time of entry, reason for entry, and

time of exit of all individuals granted access to a normally unoccupied vital area.

(e) Documentation of all routine security tours and inspections, and of all test inspections, and maintenance performed on physical barriers, intrusion alarms, communications equipment, and other security related equipment used pursuant to the requirements of this part.

(f) A record at each onsite alarm annunciation location of each alarm, false alarm, alarm check, and tamper indication that identifies the type of alarm, location, alarm circuit, date, and time. In addition, details of response by facility guards and watchmen to each alarm, intrusion, or other security incident shall be recorded.

(g) Shipments of special nuclear material subject to the requirements of this part, including names of carriers, major roads to be used, flight numbers in the case of air shipments, dates and expected times of departure and arrival of shipments, names and addresses of the monitor and one alternate monitor at each transfer point, verification of communication equipment on board the transfer vehicle, names of individuals who are to communicate with the transport vehicle, container seal descriptions and identification, and any other information to confirm the means utilized to comply with §§ 73.30 through 73.36. Such information shall be recorded prior to shipment. Information obtained during the course of the shipment such as reports of all communications, change of shipping plan including monitor changes, trace investigations and others shall also be recorded.

(h) Procedures for controlling access to protected areas and for controlling access to keys for locks used to protect special nuclear material.

§ 73.71 Reports of unaccounted for shipments, suspected theft, unlawful diversion, or industrial sabotage.

(a) Each licensee who conducts a trace investigation of a lost or unaccounted for shipment pursuant to § 73.36(f) shall immediately report to the Director of the appropriate Nuclear Regulatory Commission Inspection and Enforcement Regional Office listed in Appendix A, by telephone, telegram, or teletype, the details and results of his trace investigation and shall file within a period of fifteen (15) days a written report to the Director of the appropriate Inspection and Enforcement Regional Office with a copy to the Director of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, setting forth the details and results of the trace investigation.

(b) Each licensee shall report immediately to the Director of the appropriate Nuclear Regulatory Commission Inspection and Enforcement Regional Office listed in Appendix A, by telephone, telegram, or teletype, any incident in which an attempt has been made, or is believed to have been made, to commit a theft or unlawful diversion of special nuclear material which he is licensed to possess, or to commit an act of industrial sabotage against his plant. The initial report shall be followed within a period of fifteen

(15) days by a written report submitted to the Director of the appropriate Inspection and Enforcement Regional Office, with a copy to the Director of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, setting forth the details of the incident. Subsequent to the submission of the written report required by this paragraph, a licensee shall immediately inform the Director of the appropriate Inspection and Enforcement Regional Office by means of a written report of any substantive additional information, which becomes available to the licensee, concerning the incident.

ENFORCEMENT

§ 73.80 Violations.

An injunction or other court order may be obtained prohibiting any violation of any provision of the Atomic Energy Act of 1954, as amended, or Title II of the Energy Reorganization Act of 1974, or any regulation or order issued thereunder. A court order may be obtained for the payment of a civil penalty imposed pursuant to section 234 of the Act for violation of section 53, 57, 52, 63, 81, 82, 101, 103, 104, 107, or 109 of the Act, or section 206 of the Energy Reorganization Act of 1974, or any rule, regulation, or order issued thereunder, or any term, condition, or limitation of any license issued thereunder, or for any violation for which a license may be revoked under section 186 of the Act. Any person who willfully violates any provision of the Act or any regulation or order issued thereunder may be guilty of a crime and, upon conviction, may be punished by fine or imprisonment or both, as provided by law.

APPENDIX C

TRAINING, EQUIPPING, AND QUALIFYING OF GUARDS AND WATCHMEN

A. INTRODUCTION

Section 73.50 of 10 CFR Part 73, "Physical Protection of Plants and Materials," requires fuel reprocessing licensees and persons licensed to possess certain specified quantities of special nuclear material (SNM), respectively, to provide trained and equipped guards and watchmen to physically protect their facilities and to protect the SNM in their possession against theft. Further, Sections 73.30 through 73.36 of 10 CFR Part 73 require certain shipments of SNM to be accompanied by guards as escorts. This guide provides criteria acceptable to the Regulatory staff for a program for training, equipping, and qualifying guards and watchmen.

B. DISCUSSION

Guards and watchmen responsible for the protection of SNM onside and in transit and for the protection of the facility against industrial sabotage should, like other components of the physical security system, meet minimum levels of performance and reliability. The licensee should assure that those responsible for security are capable, and qualified to execute the duties prescribed for them. Performance and reliability of the guard force can be assured by strict adherence to a program of:

1. Preemployment screening,
2. Training and qualification, and
3. Testing and requalification.

Preemployment screening provides a means to determine whether a prospective security employee is trustworthy and capable of performing the security tasks that will be assigned to him.

Training and qualification of guards and watchmen are necessary to assure knowledge of the facility licensee's or transport licensee's (transporter) security plan and to assure a thorough understanding as to exactly what is and what is not expected of each guard and watchman. Further, the legal responsibilities and limitations involved in the execution of his duties should be made clear to every guard and watchman. Special emphasis should be given to the bearing and use of firearms.

Testing and requalification is needed to ensure the continued performance and reliability of guards and watchmen as components of the security system.

The licensee should provide all guards and watchmen training with regard to the details of the security plan they are expected to follow. The specific physical and training requirements of each guard and watchman will depend upon the duties charged to that guard or watchman.

The Commission's regulations make the following distinction between guards and watchmen: guards are armed and uniformed and have protection of SNM against theft and/or the protection of a plant against industrial sabotage as their primary duty;

watchmen, who may or may not be armed and uniformed, protect the plant and the SNM therein in the course of other duties. For the purpose of this guide, the term watchman will refer to an individual who is never armed, and a third category, patrol watchman, will be considered as an arms qualified individual who may be issued arms during an emergency or threat situation and whose primary duty, at least during an emergency or threat situation, is the protection of the plant and the SNM therein.

For material shipments, armed escorts and armed monitors are considered guards, and unarmed escorts are considered patrol watchmen.

C. REGULATORY POSITION

A program acceptable to the Regulatory staff for the pre-employment screening, training, testing, equipping, and qualifying of licensee security personnel should include the following:

1. Preemployment Screening

a. Minimum Qualification

Preemployment screening should be designed to assess the suitability of an applicant for consideration as a member of the licensee's security organization. The following are minimum qualifications:

(1) Minimum age of 21.

(2) Minimum education high school diploma or equivalent,

(3) No record of felony convictions.

(4) General good health as determined by a physician prior to employment.

b. Employment Application

An employment application should be used to provide a basis for the screening process. The application should contain the following information:

- (1) Full name,
- (2) Date and place of birth,
- (3) Citizenship,
- (4) Current residence,
- (5) Prior residences (past 5 to 10 years),
- (6) Educational background (institutions, dates),
- (7) Previous employment history (full adult life) including supervisors, employment function, reason for termination.
- (8) Military service,
- (9) Record of criminal convictions.

c. Physical Capabilities

- (1) All security personnel should be capable of arduous physical exertion and be able to withstand exposure to unusual or inclement weather,
- (2) All security personnel should have vision correctible to 20/20 (Snellen) in each eye,
- (3) All security personnel should have hearing loss not exceeding 30 dB in both ears, or 35 dB in the poorer ear, relative to normal hearing,
- (4) All security personnel should be mentally alert and capable of understanding and performing the duties assigned.

d. Contract Service

If the licensee chooses to use a contract guard service, he should accept only security personnel who have undergone preemployment screening and who meet the qualifications prescribed above.

2. Training

Prior to assignment of security duties, each guard, watchman, and patrol watchman, whether hired by the licensee or provided by a contract service, should successfully complete a training program consisting of the following:

a. General training as outlined in ... this guide,

b. Training specific to the facility or transport licensee's security plan for normal, emergency, and threat situations as outlined in ... this guide.

3. Testing and Requalification

Each guard, watchman, and patrol watchman should be tested and requalified according to the following schedule:

a. Facility or transport security plan: general duties and responsibilities of security personnel--annually.

b. Facility or transport security plan: specific duties and responsibilities as assigned--semiannually,

c. Communication equipment and security equipment as appropriate--semiannually,

d. Arms qualification for guards and patrol watchmen (... semiannually,

e. Medical examination--annually.

4. Equipment

The facility licensee, transporter, or contract service should issue uniforms, firearms, communication devices, and other security equipment as appropriate. Inspections should be conducted and documented by the security supervisor of the facility or transporter or by another individual designated by the licensee at least quarterly to assure proper care and condition of said equipment.

a. As a general practice, uniforms issued to guards and uniformed watchmen and patrol watchmen should be markedly distinct from those of local law enforcement authorities.

b. On-duty guards should be armed with sidearms of not less than caliber .38. Weapons should be kept loaded at all times while being carried by guards.

c. Weapons such as shotguns, rifles, riot guns, tear gas, and mace should be available and issued to guards and patrol watchmen as necessary. Such weapons should be loaded only upon issue, and should remain loaded for as long as they are carried by the guards or patrol watchmen.

d. Guards and watchmen on patrol should carry radio communication devices. An intercom or other means should be used to provide communication in areas of the facility where direct radio communication is not possible.

e. Fixed-site security organizations should be provided with at least one dedicated vehicle, such as a jeep, equipped with two-way radio communication for the purpose of quick response to intrusion or to an alarm. If the patrol

area is so large that only patrol by vehicle is practical, at least one other dedicated vehicle should be provided. In addition to radio communication, vehicles used for response to intrusion or for armed escort of SNM shipments should be equipped with a loaded shotgun or riot gun, extra rounds of ammunition, flares, spare batteries for communication devices, spotlights, a CO₂ or dry powder fire extinguisher, and a first aid kit.

D. GENERAL TRAINING PROGRAM

This section lists topics and suggested time allotments for a 10-day general training program for guards and watchmen. The program is divided into two sections: points of law and security skills. The section of points of law is not intended to be a course in all aspects of the law, but rather is intended to introduce the guards and watchmen to, and familiarize them with, some essential principles of law of which the guards and watchmen should have a basic understanding in order to assist and protect them in the proper performance of their duties. Hence, the topics listed in that section should be covered in sufficient depth to assure that each guard, watchman, and patrol watchman possesses an understanding of (1) the general limits of legal authority of a private security guard as provided by State statutes and the common law, (2) the differences between a felony and a misdemeanor insofar as that difference affects his authority, (3) the permissible legal extent of a search and seizure as affected by his suspicion of a crime and by his actual witness of a crime, (4) the evidence generally

necessary to prove the commission of a crime and particularly the importance of the preservation of "real evidence," and (5) the use of force legally permissible in self defense or in prevention of a crime involving property. The section on security skills should be directed at enabling security personnel to (1) perform their security duties in an effective manner, (2) effectively cooperate with other security personnel (including Federal, State, or local law enforcement authorities) responding to a request for assistance, and (3) effectively defend themselves and others, if necessary.

The program need not be limited to the topics listed herein, and other subjects may be included. Reasonable latitude is expected to enable the licensee to develop his training program to best suit his needs. When formulating and implementing his training program, the licensee should consult with and obtain the advice of State and local law enforcement authorities.

1. Scope

The general training program should be adequate to help assure that the licensee's guards and watchmen are capable of providing protection of the facility against sabotage or SNM from theft, either in transit or at a fixed site, until the arrival of assistance from law enforcement authorities. The following potential sources of threats should be considered in the training program:

- a. Lone individuals familiar with the construction and operation of the facility or the routing of vehicles transporting SNM,
- b. A group of several individuals, some of whom may be armed with weapons such as rifles, sidearms, and explosives.

- c. A group of unarmed individuals engaged in disorderly conduct or mob activities.

2. Topics

The following is a list of topics which should be presented, with suggested corresponding time allotments, in the 10-day training program. This list is not intended to be all inclusive nor is any recommendation made as to the order of presentation.

Points of Law -- For this part of the training program to be successful, the legal concepts in this section of the program should be directly related to, and discussed in the narrow context of, the duties that guards, watchmen, and patrol watchmen are expected to perform. It is suggested that approximately three days (24 hours) of the 10-day program be devoted to discussion of the topics listed below:

Role of Law Enforcement----- 1 hour

A brief history of the development of law enforcement, division of legal authority (e.g., Federal, State, and local), and law enforcement ethics.

Legal Phrases and Definitions----- 2 hours

An explanation of the meanings and legal significance of the most commonly used legal phrases that a guard or watchman is likely to encounter.

Crimes and Elements----- 3 hours

Common law and/or statutory elements necessary for establishing certain specific crimes (e.g., assault, assault and battery, burglary, breaking and entering, larceny, receiving stolen property, carrying a concealed weapon, robbery).

Laws of Arrest (Criminal Laws)----- 4 hours

A discussion of the legal authority to make arrests (without a warrant), probable cause, due process, rights of the accused, and other constitutional guarantees. Discussion should emphasize amount of force permissible when making arrest and situations where State law justifies use of "killing force."

Rules of Evidence----- 4 hours
Brief instruction in the fundamental concepts and rules of evidence, generally what is admissible and what is inadmissible in court as evidence, and methods of preserving real evidence.

Search and Seizure----- 4 hours
An introduction to laws, rules, and methods of lawful search and seizure specifically as they pertain to private security guards and watchmen.

Techniques and Mechanics of Arrest----- 4 hours
Basic police techniques and methods used to make proper arrests and safe searches.

Examination----- 2 hours
An examination should be given at the completion of this section. A passing grade should be established as one of the requirements for satisfactory fulfillment of the course.

Security Skills -- Approximately seven days (56 hours)

of the 10-day training program should be devoted to the following practiced security skills:

Self Defense----- 16 hours
(for guards and patrol watchman)
A discussion of defensive weapons and methods of defending oneself against attack. Up to six hours of physical training should be included.

First Aid----- 8 hours
Basic first aid techniques in emergency situations. American Red Cross Standard Course should be taught.

Response to Crimes in Progress----- 3 hours
Descriptions of the proper action to be taken upon observing or being notified of a crime in progress.

Patrol Procedures----- 4 hours
A discussion of functional patrol procedures and methods in private property patrol, both on foot and by vehicle.

Crowd and Mob Control----- 4 hours
Crowd control problems frequently faced by special officers. State and Federal laws and court rulings as well as police handling and control.

Firearms Training----- 16 hours
(for guards and patrol watchman)

Firearms training for those who are armed while on duty should be required in addition to the basic training course. Training should include weapons familiarization, weapons safety, and range firing of revolvers and shotguns.

Firemanship----- 3 hours

A brief training period discussing the methods of fire safety, fire prevention, and fire control.

Examination----- 2 hours

An examination should be given at the completion of this section. A passing grade should be established as one of the requirements for satisfactory fulfillment of the course.

E. FACILITY OR CARRIER TRAINING PROGRAM

This section lists topics and suggested time allotments for a 5-day (3-day for transporter guards) program of training specific to the duties and responsibilities of guards, watchmen, and patrol watchmen under the facility or carrier security plan.

1. Scope

Training with respect to the licensee's security plan should be adequate to ensure that the licensee's guards and watchmen are fully aware of the duties and responsibilities charged to them under normal operating conditions, emergency conditions, and threat situations. It should be emphasized and clearly understood by every member of the security organization that under threat situations the primary responsibility of the licensee's security organization is to provide protection until the arrival of assistance from local law enforcement authorities.

The training program should emphasize that guards and armed patrol watchmen are not to display or discharge their weapons, but are to keep their weapons in their holsters and are not to withdraw and discharge their weapons except in situations when such conduct would be permitted under the law of the State in which the facility is located or under the law of the State through which the vehicle transporting special nuclear material is traveling.

At no time should a guard or armed patrol watchman fire a "warning shot" into the air or ground. Warnings should be given verbally. Above all, it should be stressed to the guards the vital importance to the public health and safety and to the common defense and security of the United States that the unauthorized removal of special nuclear material from the facility or vehicle transporting the special nuclear material or the industrial sabotage to the facility be prevented.

2. Topics

Security Overview----- 3 hours
(2 hours for transporter escorts)

A discussion of the objectives of security plan, details of security organization structure, and command responsibility.

Records and Reports----- 3 hours
(2 hours for transporter escorts)

Detailed description of licensee procedures for completing status, inspection, tour, and other appropriate routine and special reports.

Facility Alarm System:----- 8 hours
(Fixed site guards and watchmen)

Discussion of intrusion alarms used at the facility, their operation, location, and testing procedures. Explanation of the alarm testing schedules. Field demonstrations of alarm equipment.

SNM Transport Vehicles----- 1 hour
 (Transporter escorts)
 A description of the vehicles used to transport
 SNM and of the methods of packaging SNM for shipment.

Communication Equipment----- 1 hour
 Operation and routine testing of communications
 devices used by the licensee.

Routine Procedures----- 8 hours
 (Fixed site guards and watchmen)
 A variety of topics should be covered; among them
 are: identification checks: badges and badging
 procedures; detection equipment used by licensee;
 vital areas, what they contain, why they are vital;
 escort procedures within protected area; personnel
 and package searching procedures; patrol and
 inspection procedures.

Emergency Procedures----- 4 hours
 (Fixed site guards and watchmen)
 Fire and criticality evacuation procedures, location
 of fire equipment, and security procedures under
 emergency conditions.

Emergency Procedures----- 3 hours
 (Transporter escorts)
 Security procedures following a vehicle accident.

Routine Procedures----- 3 hours
 (Transporter escorts)
 Discussion of check-in procedures, detour policy,
 and shift-change procedures (long hauls).

Threat Situations----- 3 hours
 Types of credible attack and expected response.
 Procedures for calling for assistance: who to call,
 when, what information is to be given.

Use of Firearms----- 2 hours
 Proper use of firearms during threat situations
 emphasizing permissible use of force in various
 situations.

Radiological Safety----- 5 hours
 Areas where SNM is found at the facility, type and
 form of the SNM stored, processed, or transported,
 and identifying characteristics of SNM containers.
 Provisions of the Commission's regulations for the
 protection of personnel against exposure, health
 problems associated with exposure, precautions and
 procedures to minimize exposure, and proper handling
 procedures for SNM.

Examination----- 3 hours
(2 hours for transporter escorts)

In addition to the above topics, training should include up to six weeks of on-the-job supervision.

E. ARMS QUALIFICATION PROGRAM

Guards, and other individuals who may be issued arms during a threat situation (e.g., patrol watchmen), should qualify semiannually on one of the following courses:

SHORT COURSE						
Range	Type Fire	Time	No. Shots	No. Strings	Target	Maximum Points
25 yd	Slow	5 min	5	2	25 yd (SF)	100
25 yd	Timed	20 sec	5	2	25 yd (TF)	100
25 yd	Rapid	10 sec	5	2	Silhouette	100

Target Specifications:

25 yd (SF) - 21 in. x 24 in. with No. 7, 8, 9, and 10 rings black and black area 5.50 in. diameter (B-16).

25 yd (TF) - 21 in. x 24 in. with No. 9 and 10 rings black and black area 5.54 in. diameter (B-8).

Silhouette - B-27

Guards must achieve a minimum point total of 175.

1. National Police Course - Firing Stages:

- a. Seven-Yard Course: Twelve shots double action from the crouch position. Time starts with gun in holster and includes reloading for second six shots. Time allowed: 25 seconds.
- b. Twenty-Five-Yard Course: Six shots kneeling, double action; six shots standing, double action, left hand from behind barricade; six shots standing, double action, right hand from behind barricade. Time allowed: 90 seconds.

- c. Fifty-Yard-Course: Six shots sitting, six shots prone, six shots left hand police standing from behind barricade, and six shots right hand from barricade single action. Time allowed: 2 minutes and 45 seconds.
- d. Twenty-Five-Yard Course: Six shots standing without support, single action. No barricade or other support is used. Time allowed: 12 seconds.

Target Specifications: B-27 Target

Guards must achieve a minimum percentage score of 70%.

In addition, guards and patrol watchmen should be instructed in the use of mace or tear gas if provided by the licensee or contract service.

BIBLIOGRAPHY

BOOKS

- Bell, J. B., Transnational Terror, p. 11, American Enterprise Institute for Public Policy Research, 1975.
- Congressional Research Service Library of Congress, Facts on Nuclear Proliferation: A Handbook, p. 185, U.S. Government Printing Office, December 1975.
- Glasstone, S., Sourcebook on Atomic Energy, 3rd ed., p. 530-533, D. Van Nostrand, 1967.
- Glasstone, S., ed., The Effects of Nuclear Weapons, p. 16-23, United States Atomic Energy Commission, April 1962.
- Taylor, T. B. and Willrich, M., Nuclear Theft: Risks and Safeguards, p. 13-112, Ballinger, 1974.
- U.S. Senate Committee on Government Operations, Peaceful Nuclear Exports and Weapons Proliferation, A Compendium, p. 472, April 1975.
- Willrich, M., ed., International Safeguards and Nuclear Industry, p. 13, 191, John Hopkins University Press, 1973.
- Zwicky, F. and Wilson, A. G., ed., New Methods of Thought and Procedure, p. 273-313, Springer-Verlag, 1967.

TECHNICAL REPORTS

- Advanced Research Projects Agency Report 1141, The Unconventional Nuclear Threat - A Preliminary Survey (U), E. M. Kinderman, T. B. Taylor, and W. R. Van Cleave, p. 83-84, Secret, May 1969.
- Institute For Energy Analysis, The Hazards in Plutonium Dispersal, Cohen, B. L., p. 10, March 1975.
- United States Atomic Energy Commission, Proposed Final Environmental Statement, LMFBR, V. IV, p. 7.4-1, December 1974.
- United States Atomic Energy Commission, Special Safeguards Study, Rosenbaum, D. M., and others, p. 3, April 1974.
- U.S. Energy Research and Development Administration Report At (49-1) - 3665, LDC Nuclear Power Prospects, 1975-1990; Commercial, Economic and Security Implications, Richard J. Barber Associates, Inc., 1975.

PERIODICALS

"Can We Afford a Plutonium Economy," Natural Resources Defense Council Newsletter, Summer/Fall 1974.

Lanouette, W. J., "Homemade Nukes: Closer Than You Think," The National Observer, V. 39, p. 3, 16 March 1974.

Lotts, A. L., and others, "The Status of Thermal Reactor Fuel Manufacture in the United States," Peaceful Uses of Atomic Energy, V. 8, p. 201, 1972.

Phillips, J. G., "Energy Report/Safeguards, Recycling Broadens Nuclear Power Date," National Journal Reports, p. 420, 22 March 1975.

Segre, D. V. and Adler, J. H., "The Ecology of Terrorism," Survival, V. XV, p. 178-183, July/August 1973.

Shapley, D., "Plutonium: Reactor Proliferation Threatens a Nuclear Blackmarket," Science, p. 19, 68, 9 April 1971.

United States Atomic Energy Commission, "Training, Equipping, and Qualifying of Guards and Watchmen," Regulatory Guide, V. 5.20, p. 4, January 1974.

"World List of Nuclear Power Plants," Nuclear News, V. 18, p. 63, August 1975.

ARTICLES

Burnham, D., "U.S. Says Lost Plutonium is 'Only Small Amount'," The New York Times, p. 54, 3 January 1975.

Donnelly, W. H., "Special Nuclear Materials: Safeguards Issue Brief Number IB74077," The Library of Congress Congressional Research Service, p. 2, 31 January 1975.

Fearey, R. A., Terroristic Activity, International Terrorism, Hearings before the Administration of the Internal Security Act and Other Internal Security Laws of the Committee of the Judiciary, U.S. Senate, 14 May 1975.

Foster, J. S., "Nuclear Weapons," Encyclopedia Americana, V. 20, p. 520-522, Americana Corporation, 1973.

Jenkins, B., Will Terrorists Go Nuclear, Rand Corporation, p. 3, May 1975.

Jenkins, B. M., High Technology Terrorism and Surrogate War: The Impact of New Technology on Low-Level Violence, p. 11, Rand Corporation, January 1975.

Larson, H. J., Pivotal Safeguards Issues Viewed by NRC, paper presented at the Institute of Nuclear Material Management 1975 Annual Meeting in New Orleans, Louisiana, 20 June 1975.

Nixon, R. M., Cabinet Committee to Combat Terrorism, The President's memorandum to the Secretary of State on the establishment of the Committee, 25 September 1972.

Reese, W., Nuclear Weapons and Foreign Policy, unpublished class notes presented at the Naval Postgraduate School, 1975.

LEGISLATION and REGULATION

"Energy Reorganization Act of 1974," Public Law 93-438, 93rd Congress, H.R. 11510, 11 October 1974.

United States Nuclear Regulatory Commission, Rules and Regulations, Title 10 CFR, part 73, "Physical Protection of Plants and Materials," Section 73.31-73.35.

INITIAL DISTRIBUTION LIST

	No. Copies
1. Defense Documentation Center Cameron Station Alexandria, Virginia 22314	2
2. Library, Code 0212 Naval Postgraduate School Monterey, California	2
3. Department Chairman, Code 56Hf Department of National Security Affairs Naval Postgraduate School Monterey, California 93940	2
4. Assoc. Professor R. H. Stolfi, Code 56Sk Department of National Security Affairs Naval Postgraduate School Monterey, California 93940	1
5. LT Robert C. Mabry, USN Naval Special Warfare Group One NAB, Coronado, California 92155	1



Thesis
M107 Mabry
c.1

166175

Nuclear theft: Real
and imagined dangers.

RECEIVED
15 MAR 79
1 FEB 80
JUN 15 80

01605
25523
28477
30316

Thesis
M107 Mabry
c.1

166175

Nuclear theft: Real
and imagined dangers.

thesM107

Nuclear theft :



3 2768 000 98364 7

DUDLEY KNOX LIBRARY